

# Wide Area Multilateration Surveillance System Program

## Site Engineering Report For Juneau International Airport (JNU) in

Juneau, Alaska

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Prepared For:  
Federal Aviation Administration  
Operations Planning Technology Development  
800 Independence Ave., S.W., Room 335W  
Washington, DC 20591



5793 Widewaters Parkway  
DeWitt, New York 13214  
(315) 445-0550  
FAX: (315) 445-9401  
CAGE Code: 1EG52

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Quality Management System

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“JUNEAU, ALASKA WIDE AREA MULTILATERATION (WAM) SITING ANALYSIS”, DOC. NO. 840-012199,  
VERSION: 2, DATE: 6/24/04

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## 1. INTRODUCTION

The Wide Area Multilateration (WAM) Surveillance System is an automatic detecting, high-resolution surveillance radar system that will track and identify aircraft and provide for air traffic control efficiencies through surveillance in terrain constrained areas. The WAM system detects, identifies, and tracks transponder and ADS-B equipped aircraft. This multi-sensor system is designed to increase situational awareness and to alert air traffic controllers of impending collisions, controlled flight into terrain incidences, and flight path incursions, in time to prevent such occurrences.

The flying environment in Southeast Alaska is characterized by 1) the lack of radar coverage below 10,000 feet; 2) a geographically contained aircraft fleet; 3) limited weather reporting capabilities; 4) limited National Airspace System (NAS) instrument routes and approach structures; and 5) a representative number of Alaskan accidents.

The WAM hardware and software suite of components is manufactured by **Sensis Corporation** of Dewitt, New York (hereinafter, Sensis) and is proposed for installation to support the *FAA Alaskan Regional Office and the Capstone Program* (Capstone). Capstone is a joint industry and FAA Alaskan Region effort centering on aviation safety and efficiency improvements.

### 1.1. Scope

This document constitutes the WAM Draft Site Engineering Report (SER) describing site preparation requirements to be managed by the FAA in readiness for installation of a WAM system at Juneau International Airport (JNU) in Juneau, Alaska. It describes construction site preparation tasks that will facilitate the installation of 7 Multilateration Remote Units (RU) and 2 Ground Based Transmitters (GBT) for the surveillance area. This SER also describes site preparation requirements for installation of other system components, including system equipment cabinets. The equipment cabinets involved in the processing and interpretation of the radar data will be installed within the Flight Service Station (FSS).

Site preparation by the FAA for WAM system installation includes modifications to the current JNU infrastructure to accommodate the system's spatial requirements as well as system power, grounding, surge protection, communications, HVAC, and maintenance accessibility requirements.

The plans/requirements in this document are based on the findings and agreements formed during the Site Engineering Survey (SES), conducted on the week of 5/10/2004 – 5/14/2004. These plans/requirements will be finalized during review of this document and any changes that occur after the initial release will be documented in a revision.

## 1.2. Applicable Documents

This SER is a guidance document only and assumes that the FAA will abide by the latest applicable codes, orders, specifications, and standards when designing and performing site preparation tasks. The requirements set forth in the documents, included in the attached Appendices and in the following list of specifications, standards, and orders should be considered and followed during design, site preparation, and installation activities. The following list is not intended to be exclusive of other applicable documents.

**Table 1 Applicable Documents**

Standard	Description
FAA-E-2942	Airport Surface Detection Equipment-Model X (ASDE-X)
FAA-C-1391b	Installation and Splicing of Underground Cables
FAA-C-1217f	Electrical Work, Interior
FAA-G-2100G	Electronic Equipment, General Requirements, October 22, 2001
FAA-STD-019c <sup>(1)</sup>	Lightning Protection, Grounding, Bonding and Shielding Requirements for Facilities dated June 1, 1999
FAA-STD-019d <sup>(1)</sup>	Lightning Protection, Grounding, Bonding and Shielding Requirements for Facilities dated August 9, 2002.
FAA-C-2454	Facility Site Preparation
FAA Order 1050.1D	Policies and Procedures for Considering Environmental Impacts
FAA Order 6950.19	Practices and Procedures for Lightning Protection, Grounding, Bonding, and Shielding Implementation
FAA Order 6950.20	Fundamental Considerations of Lightning Protection, Grounding, and Shielding
FAA-STD-032	Design Standard for National Airspace Facilities
FAA Part 77	Objects Affecting Navigable Airspace
FAA Form 7460-1	Notice of Proposed Construction or Alteration
RR-F-191K/Gen	General Requirements for Chain Link Fencing
AC70/7460-2K	Advisory Circular Construction or Alteration of Objects that may affect navigable Airspace
NFPA – 70	National Electrical Code (NEC)
NFPA – 780	Standard for the Installation of Lightning Protection Systems 1997 Edition

- (1) The WAM system is required to comply with FAA-STD-019c. However the most recent version of this standard is FAA-STD-019d, dated August 9, 2002, to which FAA site preparation efforts will comply.

### 1.3. Point-of-Contact (POC)

Point of Contact information related to Juneau International Airport (JNU) and the WAM installation is listed below:

**Table 2 Points of Contact**

<b>Name</b>	<b>Organization/Title</b>	<b>Telephone</b>	<b>E-Mail</b>
Walter Combs	FAA ANI 770	907-271-5379	<a href="mailto:walter.combs@faa.gov">walter.combs@faa.gov</a>
Ed Doherty	SA SMO Capstone	907-271-1671	<a href="mailto:ed.doherty@faa.gov">ed.doherty@faa.gov</a>
Alice Salzman	FAA-AAL-59RE	907-271-5876	<a href="mailto:alice.salzman@faa.gov">alice.salzman@faa.gov</a>
Steve Turner	JNU ATCT	907-586-7411	<a href="mailto:steve.d.turner@faa.gov">steve.d.turner@faa.gov</a>
Fred Fraiser	GLC SSC/ JNU AK	907-586-7542	<a href="mailto:fred.fraiser@faa.gov">fred.fraiser@faa.gov</a>
Allan Heese	JNU	907-789-7821	<a href="mailto:allan_heese@ci.juneau.ak.gov">allan_heese@ci.juneau.ak.gov</a>
Rick Wery	JNU AFSS	907-586-7521	<a href="mailto:rwery@gci.net">rwery@gci.net</a>
Allan Overbey	ATO-P/Tech Development	202-267-9741	<a href="mailto:allan.ctr.overbey@faa.gov">allan.ctr.overbey@faa.gov</a>
Chuck Davis	Sensis	253-549-2775	<a href="mailto:chuck.davis@sensis.com">chuck.davis@sensis.com</a>
Alex Fairbank	Sensis	315-445-5770	<a href="mailto:alexf@sensis.com">alexf@sensis.com</a>
Matt Massiano	Sensis	315-445-5735	<a href="mailto:mattm@sensis.com">mattm@sensis.com</a>
Jean Southwick	Sensis	315-445-5739	<a href="mailto:Jean.southwick@sensis.com">Jean.southwick@sensis.com</a>
Michael Willis	Raytheon	781-238-3024	<a href="mailto:michael_willis@raytheon.com">michael_willis@raytheon.com</a>

## 1.4. System Description

The core WAM system consists of two Ground Base Transmitters, co-located with multiple Multilateration sensors capable of receiving Automatic Dependent Surveillance Broadcast (ADS-B), Mode S, and ATCRBS transponder signals. These are supported by associated communications, multiprocessor, and display processing components. The WAM Multiprocessor subsystem combines independent surveillance data from multilateration sensors with cooperative and dependent data from the Multilateration subsystem to provide a single target with Flight ID for display to Air Traffic Control. The system is capable of using all sensors at once, or using each sensor alone. **Error! Reference source not found.** 1 and 2, below, show simplified block diagrams of the WAM functions.

### Phase 1B Architecture

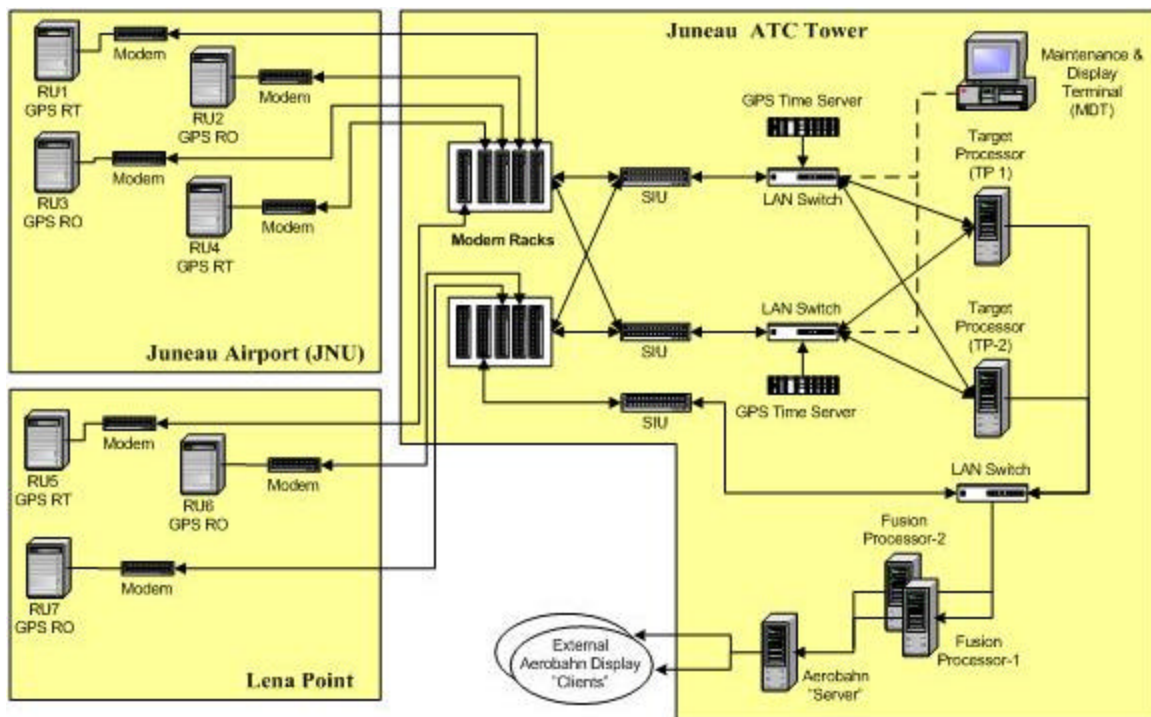


Figure 1 WAM Functional Block Diagram, Phase 1B

## Phase 1C Architecture

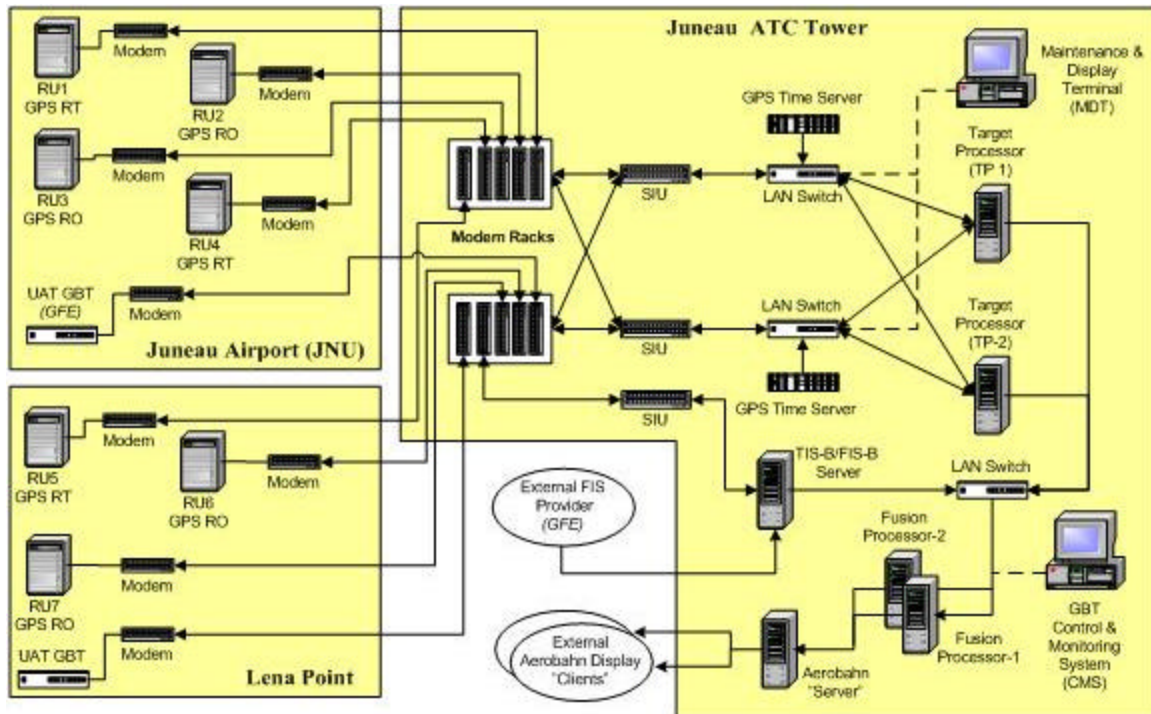


Figure 2 WAM Functional Block Diagram, Phase 1C

The WAM system will be able to operate in two modes: operational and maintenance. When in operational mode, the system will not be accessible for adjustments by personnel other than controllers. Operational mode will contain those capabilities that allow efficient and safe control of airport traffic. Maintenance mode will enable tools and information not present in operational mode to allow technicians to diagnose problems and optimize the system.

## 1.5. Background

A pre-site survey was conducted by Sensis and FAA personnel on 1/25/2001 and 1/26/2001. This pre-site survey was performed to evaluate optimum locations for the various components of the Multilateration System. A pre-site survey report, written by Sensis and dated 1/25/2001, summarized the requirements for each proposed installation location, both on airport and along the Gastineau Channel.

On 8/20/2001 – 8/24/2001 a more detailed survey was performed to evaluate the on airport movement area and the flight path up the Gastineau Channel with respect to locations for the various components of the WAM system and to support the generation of the SER. Multiple sites were surveyed with existing infrastructure to support the WAM system. Representatives of the FAA, Sensis, and Raytheon Technical Services Company LLC (RTSC) conducted the SES jointly. Two SER's were generated from this visit.

On 5/5/2004, Sensis delivered the document “Juneau, Alaska Wide Area Multilateration (WAM) Siting Analysis”, Doc. No. 840-012199, Version: 1.0.

On 5/10/2004 through 5/14/2004, a detailed site engineering survey was performed to evaluate the airport configuration with respect to locations for the various components of the WAM system around the Greater Juneau Area and to support the generation of the SER. Representatives of the FAA, Sensis, and RTSC conducted the SES jointly.

At the conclusion of each day of the SES, an analysis was conducted to determine if the locations visited provided sufficient coverage. The information gathered from the SES was used to develop “Juneau, Alaska Wide Area Multilateration (WAM) Siting Analysis”, Doc. No. 840-012199, Version: 2, Date: 6/24/04.

## 1.6. Siting Analysis

A document, “Juneau, Alaska Wide Area Multilateration (WAM) Siting Analysis”, Doc. No. 840-012199, Version: 2, Date: 6/24/04 is attached as Appendix B. The Siting Analysis details the coverage and accuracy performance of the WAM at JNU within the coverage area as defined by the FAA. Critical RU failure scenarios and their impact on coverage, interrogation, and precision are detailed as well.

## 1.7. System Component Location Summary

The proposed installation locations for all the WAM components are identified in **Table 3: System Component Location Summary**, and shown on the airport layout diagram in **Figure 3 – WAM Equipment Installation Locations**.

**Table 3 System Component Location Summary**

<b>Component</b>	<b>Qty</b>	<b>Installation Location</b>	<b>Designation (For Figures)</b>
<b>Equipment in FSS</b>			
<b>Data Distribution Maintenance Cabinet</b>	<b>1</b>	<b>FSS Equipment Room</b>	<b>FSS</b>
<b>Processor Cabinet</b>	<b>1</b>	<b>FSS Equipment Room</b>	<b>FSS</b>
<b>Communications Cabinet</b>	<b>1</b>	<b>FSS Equipment Room</b>	<b>FSS</b>
<b>Maintenance Display Terminal (MDT) Workstation</b>	<b>1</b>	<b>FSS Equipment Room</b>	<b>FSS</b>
<b>Dual GPS Antenna</b>	<b>1</b>	<b>Roof of FSS</b>	<b>FSS</b>
<b>GPS Surge Protection Polyphaser</b>	<b>2</b>	<b>Drop Ceiling FSS</b>	<b>FSS</b>

<b>WAM Area Coverage</b>			
<b>RU Receive Only (RO) Or Receive/Transmit (RT)</b>	<b>7</b>	<b>ATCT</b>	<b>01</b>
		<b>AT&amp;T Lena Point Tower</b>	<b>02</b>
		<b>Lena Point FAA RCAG Site</b>	<b>03</b>
		<b>AT&amp;T Mile 11 Tower Site</b>	<b>04</b>
		<b>Pederson Hill</b>	<b>05</b>
		<b>Lemon Creek Police Station</b>	<b>06</b>
		<b>Saddle Mountain Police Radio Site</b>	<b>07</b>
<b>GBT Ground Based Transmitters</b>	<b>2</b>	<b>ATCT</b>	<b>GBT1</b>
		<b>Lena Point FAA RCAG Site</b>	<b>GBT2</b>

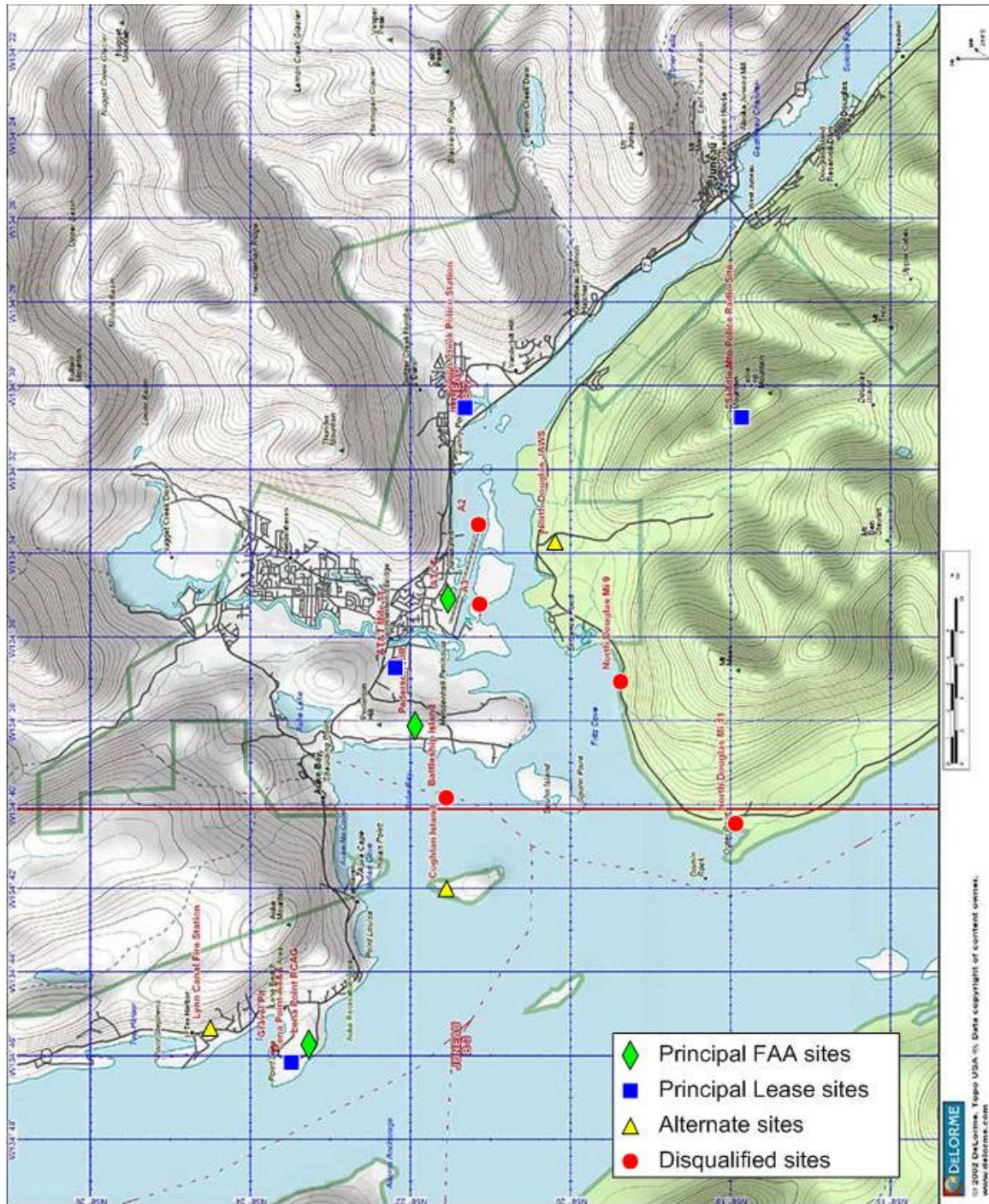


Figure 3- WAM Equipment Installation Locations

## **2.0 FAA SITE PREPARATION REQUIREMENTS – ASDE-X SUBSYSTEM COMPONENTS**

The ASDE-X System Installation Constraints Table, Sensis Doc. No. 830-009924, Version 7 (see Appendix A), shows the physical relationship between all ASDE-X System Components. The JNU WAM System is comprised of similar components. Refer to section pertaining to the Remote Units – pg. 2, GPS Antenna and Processor Cabinet – pg. 5, Communications Cabinet – pg. 6, RMS Workstation – pg. 7, Baseline Configuration block diagram – pg. 12, and Data Distribution – pg. 19.”

Sections 2.1 through to 2.3 describe existing conditions in the FSS relevant to installation of system components. These sections also describe site preparation tasks that should be performed by the FAA to facilitate installation of these WAM components.

Specific site preparation drawings can be found in Appendix D.

## **2.1. FSS Equipment Room**

The following Sensis-supplied WAM system components will be installed in the FSS Equipment Room (see Figures 00A and 00B Appendix E and Drawings WAMSS-JNU-SER-00A and WAMSS-JNU-SER-00B, Appendix D.):

- Processor Cabinet
- Communications Cabinet
- Data Distribution Maintenance Cabinet
- MDT Workstation

### **2.1.1. Existing Conditions**

Observations made during the SES related to the FSS Equipment Room and potentially affecting WAM equipment installation are summarized below:

- **Spatial** – The FSS Equipment Room was identified as the primary location for the WAM components. This room is configured with a raised floor and high ceiling. This room offers sufficient space to install the required WAM cabinets.
- **Environmental** – This FSS Equipment Room does have environmental controls (e.g., insulation, heat, air-conditioning, smoke/fire detection, emergency lighting, etc.), which should be adequate. However, the cooling and heating requirements for the WAM system should be examined in greater detail and modified if required.
- **Communication** – There is an existing communication demarcation panel in Communication Room 112, adjacent to the FSS Equipment Room. This demarc panel will serve as the interface to the WAM Communication Cabinet.
- **Grounding** – The Multipoint grounding plates present in this room are too full to support the additional grounding cables from the ASDE-X equipment.
- **Cable Routing** – There is an existing 18” wide communication cable tray running adjacent to Communication Room 112.

### **2.1.2. ASDE-X Equipment Placement**

After discussing and evaluating options for the WAM equipment placement within this building with Program and Local FAA representatives, the following installation configuration was chosen.

The Processor Cabinet, Communication Cabinet, Data Distribution Maintenance Cabinet, and MDT Workstation, will be located in the FSS Equipment Room. A row of desks with old typewriters, used printers, and computers will be relocated to accommodate the installation.

### 2.1.3. FAA Site Preparation

Site preparation tasks to be completed by the FAA prior to installation of the WAM components in the FSS Equipment Room include the following:

- **Spatial** – Three existing desks with materials and equipment located on top of them need to be relocated in order to create the space necessary for the WAM equipment. The FAA needs to verify and determine the final equipment layout, according to the space afforded by the room.
- **Environmental** – Evaluate the HVAC within this room to determine if there is sufficient heating, cooling, and ventilation with the addition of this equipment.
- **Communication** – A new communication demarcation punch-down block will need to be provided / installed at the existing Communication Demarcation panel, located in the FSS Telephone Room 112, to interface the incoming RU communication cables with the Communication Cabinet.
- **Electrical** – A new square duct should be installed under the raised floor directly beneath and extending the length of the WAM components. All direct power feeds and twist-lock receptacles should be installed directly onto the square duct, and located directly below their respective WAM components. Provide electrical power for the WAM components in accordance with the Sensis one-line diagram found in the ASDE-X System Installation Constraints Table (see Appendix A). Space will be provided by the FAA on Critical Power EP-5 to accommodate the WAM components. The panel is located in the FSS Equipment Room. The power requirements for these WAM components are summarized in **Table 4: Electrical Power Requirements for WAM Components in the FSS Equipment Room.**
- **Grounding** – Install a new MPG plate under the raised floor, in the FSS Equipment Room, for equipment grounding and surge protection devices. One MPG plate (approx. 4'x 8'), within 15' of the proposed WAM Cabinets will serve all the WAM components in this area.
- **Cable Routing** – All cables will be routed under the raised floor.

**Table 4 Electrical Power Requirements for WAM Components in the FSS Equipment Room**

EQUIPMENT TYPE	POWER REQUIREMENT	POWER TYPE UTILIZED	TYPE OF POWER RECEPTACLES	SOURCE POWER PANEL DESIGNATION	SOURCE POWER PANEL LOCATION	APPROX. CABLE DISTANCE FROM SOURCE TO RECEPTACLE LOCATION
Data Distribution Maintenance Cabinet	Two essential circuits @ 30A, 120 VAC and One utility circuit @ 20A, 120 VAC	Critical	Two L5-30R twist-lock receptacles and One L5-20R twist-lock receptacle	EP-5	FSS Equipment Room	25'
Processor Cabinet	Two essential circuits @ 30A, 120 VAC and One utility circuit @ 20A, 120 VAC	Critical	Two L5-30R twist-lock receptacles and One L5-20R twist-lock receptacle	EP-5	FSS Equipment Room	25'
Communication Cabinet	Two essential circuits @ 30A, 120 VAC and One utility circuit @ 20A, 120 VAC	Critical	Two L5-30R twist-lock receptacles and One L5-20R twist-lock receptacle	EP-5	FSS Equipment Room	25'
MDT Workstation.			Powered from Equipment Cabinets	N/A	N/A	N/A

Note: <sup>(1)</sup> Unless otherwise noted, all power requirements are to be 120V  $\pm$  10 %, 60Hz  $\pm$  5 %.

<sup>(2)</sup> Unless otherwise noted, twist-lock receptacles are to be installed under the raised floor in square electrical duct directly below their respective WAM components.

## **2.2. FSS – GPS Location**

The following ASDE-X system components will be located on the FSS roof:

- One Dual GPS Antenna Assembly
- GPS Surge Suppression
- Cable for GPS antennas

### **2.2.1. Existing Conditions**

Inspection of the FSS Building exterior wall revealed an existing 2' X 2' junction box and a 3" conduit routed up the side of the building to the roof which supports an existing GPS antenna installation. This condition is ideal for the installation of the WAM GPS antennas, as there is available space and we can co-locate the new GPS cables within the same routing as the existing GPS cable.

### **2.2.2. ASDE-X Equipment Placement**

The roof of the FSS Building will be the primary location for the dual GPS antennas (see Figures RU00A and RU00B Appendix E and Drawings WAMSS-JNU-SER-00A and WAMSS-JNU-SER-00B Appendix D). During the site survey, an assessment was made with a handheld WAAS enabled GPS to determine if satellite reception is acceptable. The signal strength was strong and the survey team deemed this location appropriate.

### **2.2.3. FAA Site Preparation**

Installation of the GPS antennas is a Sensis/RTSC installation task. The existing junction box and 2" conduit utilized to route the existing GPS antenna cables down to the FSS Equipment Room can be used to route the new GPS antennas cables. Therefore, site preparation tasks by the FAA for these components are minimal and include the following:

- Install a 1" GRSC conduit and supports from the existing junction box to the roof location terminating near the proposed GPS antenna location.
- Install unistrut to support the GPS Surge Suppression Polyphaser in the ceiling of the FSS equipment room.
- Install 1" conduit or duct from the ceiling above the cable tray, in the Communications Room, to the unistrut supported polyphaser.
- Install a pull string in all conduits/ducts, for the Sensis/RTSC team to pull coaxial cable.
- Provide one interior grounding source within 15' of the GPS surge suppression device (ceiling).

### **2.3. Contractor Staging Area**

The RTSC/Sensis team will establish a temporary office/storage trailer as close to the Airport as possible to support ASDE-X equipment installation activities. The temporary storage/office facility will be sited in an appropriate location deemed acceptable to FAA and airport owners/management organization(s). All installation materials, equipment, and tools used by the RTSC/Sensis team will be stored in this temporary facility.

#### **2.3.1. Existing Conditions**

The AF Glacier/Juneau SSC parking lot was identified as a potential staging site during the SES. As installation activities become scheduled, the exact location will be coordinated with the FAA WAM Point of Contact.

#### **2.3.2. ASDE-X Office/Storage Trailer Placement**

Typically an office/storage trailer 40'-long by 8'-wide trailer is used to support the installation effort. It would be delivered to the placement location approximately one week prior to the time when the ASDE-X system itself and assorted installation materials (e.g., cable, wire, hardware, tools, etc.) are shipped. The intended trailer is a modified "CONEX" storage/shipping container that is placed directly on the ground. The trailer is divided into a 12'-long office area and a 28'-long storage area. The trailer is equipped with a 50A 2 phase service panel for connecting commercial electrical power.

#### **2.3.3. FAA Site Preparation for the ASDE-X Office/Storage Trailer**

Site preparation tasks to be completed by the FAA in preparation for placement of this trailer include the following:

- Ensure that the intended installation location is free of debris and/or other materials at the time the trailer is brought on-site.
- Identify the source for power and communication to trailer:
  - (2) Communication ports for fax and phone, and
  - (1) 220V, 125Amp, 1 Phase temporary power service.
- If unavailable from an FAA source, Sensis/RTSC will hire a subcontractor to extend power and communication to the trailer a minimum of two weeks prior to equipment delivery. Power and communication will remain in place through Optimization (several months).

### 3.0 FAA SITE PREPARATION REQUIREMENTS – MULTILATERATION SUBSYSTEM COMPONENTS

**Section 3.1** describes alternate RU Sites. **Section 3.2** describes disqualified RU Sites. **Sections 3.3 through 3.14** describe site preparation tasks that will be performed by the FAA at RU and GBT locations. Upon completion of site preparation, Sensis/ RTSC will install the RUs, as well as two GBT(s) to support the coverage area. The RU and GBT locations are summarized in **Table 5: Physical Site Descriptors-Surveillance Area RU's**. Geographic coordinates (latitude and longitude) listed in Table 5, below, are those measured using WAAS-enabled hand-held GPS receivers during the SES. Power Requirements are summarized in **Table 6: Power Requirements and Sources Surveillance Area RU's**. Communication requirements are summarized in **Table 7: Communication Requirements-Surveillance Area RU's**.

**Table 5 Physical Site Descriptors - Surveillance Area RU's**

RU #	Site Descriptor	RU Type	RU Antenna Type (Quantity)	Lat (D/M)	Lon (D/M)	Height AMSL	Height AGL
GBT1	ATCT	GBT	Omni	58° 21' 32.16"	134° 35' 2.34"	102'	80'
GBT2	Lena Point FAA RCAG Site	GBT	Omni	58° 23' 17.46"	134° 45' 42.36"	318'	65'
01	ATCT	RO	Omni	58° 21' 32.16"	134° 35' 2.34"	102'	80'
02	AT&T Lena Point Tower	RO	Omni	58° 23' 28.50"	134° 46' 5.76"	346'	210'
03	Lena Point FAA RCAG Site	R/T	Omni	58° 23' 17.46"	134° 45' 42.36"	318'	65'
04	AT&T Mile 11 Tower Site	RO	Omni	58° 22' 12.12"	134° 36' 41.22"	44'	180'
05	Pederson Hill	R/T	Omni	58° 21' 56.16"	134° 38' 4.38"	492'	60'
06	Lemon Creek Police Station	RO	Omni	58° 21' 21.00"	134° 30' 28.62"	43'	35'
07	Saddle Mountain Police Radio Site	RO	Omni	58° 17' 51.18"	134° 30' 40.32"	3090'	45'

**Table 6** below lists the electric power requirements for each of the RUs and two GBT(s). Additionally, the table lists each power panel (if known) identified during the SES that will be used for electrical power source to these RUs and GBT(s). Note that this table lists just the power requirements for the RU itself; no expandability or extra utility power requirements have been factored in the table of power requirements. All power/electrical construction efforts should meet the latest version of all applicable FAA requirements (FAA-STD-1217f, FAA-STD-019d, etc.) and the National Electric Code. All conduits installed by the FAA for WAM site preparation should be equipped with a pull cord to facilitate installation activities conducted by Sensis/RTSC.

**Table 6 Power Requirements and Sources - Surveillance Area RU's**

SITE LOCATION	EQUIPMENT TYPE (2)	POWER REQUIREMENT	SOURCE POWER/PANEL MANUFACTURER	SOURCE POWER PANEL DESIGNATION (1)	SOURCE POWER PANEL LOCATION	APPROX. POWER CABLE LENGTH (RU TO SOURCE)
GBT1	Ref Tran (Site Type 4)	15A, 120V $\pm$ 10% 60Hz $\pm$ 5%	GE	NLAB	ATCT Equipment Room	35'
GBT2	Ref Tran (Site Type 4)	15A, 120V $\pm$ 10% 60Hz $\pm$ 5%	Square D	No Panel Designation	RCAG Shelter	35'
01	RO (RU Site Type 4)	15A, 120V $\pm$ 10% 60Hz $\pm$ 5%	GE	NLAB	ATCT Equipment Room	35'
02	RO (RU Site Type 4)	15A, 120V $\pm$ 10% 60Hz $\pm$ 5%	TBD	TBD	AT&T Lena Point Shelter	TBD
03	R/T (RU Site Type 4)	15A, 120V $\pm$ 10% 60Hz $\pm$ 5%	Square-D	No Panel Designation	RCAG Shelter	35'
04	RO (RU Site Type 4)	15A, 120V $\pm$ 10% 60Hz $\pm$ 5%	TBD	TBD	AT&T Mile 11 Shelter	TBD
05	R/T (RU Site Type 4)	15A, 120V $\pm$ 10% 60Hz $\pm$ 5%	TBD	TBD	Pederson Hill Shelter	TBD
06	RO (RU Site Type 4)	15A, 120V $\pm$ 10% 60Hz $\pm$ 5%	TBD	TBD	Lemon Creek Police Station	TBD
07	RO (RU Site Type 4)	15A, 120V $\pm$ 10% 60Hz $\pm$ 5%	Square D	No Panel Designation	Saddle Mountain Police Shelter	25'

Note: (1) RTSC/Sensis will install the power cable from the FAA power source (twist lock receptacle or dedicated power subpanel) during installation.

**Table 7** below, lists the communication requirements for each of the RUs; the source communication connection point identified during the SES, used for providing a communication link between each RU and the WAM Communications Cabinet in the FSS is also described. Preliminary procedures for testing airport copper communication lines are described in “Certification of Copper Pairs for 56-Kbps Digital Data Service (DDS) on Multilateration Remote Unit (RU) to System Interface Unit (SIU) Communications Link”, FAA Document, Version 0.0A”. Communication requirements for leased communication lines are described in “ASDE-X Remote Unit Communication Requirements” (see Appendix C).

**Table 7 Communication Requirements - Surveillance Area RU's**

SITE LOCATION	EQUIPMENT TYPE (1)	REQUIRED COMM	COMM SOURCE & LOCATION	APPROX. COMM CABLE LENGTH (RU. TO SOURCE)	COMM INTERFACE
GBT1	GBT (Site Type 4)	56K DDS Telco Lease Service	ATCT Equipment Room	30'	Two twisted pair comm. wires/66 block
GBT2	GBT (Site Type 4)	56K DDS Telco Lease Service	RCAG Shelter	30'	Two twisted pair comm. wires/66 block
01	RO (RU Site Type 4)	56K DDS Telco Lease Service	ATCT Equipment Room	30'	Two twisted pair comm. wires/66 block
02	RO (RU Site Type 4)	56K DDS Telco Lease Service	AT&T Lena Point Shelter	N/A	Two twisted pair comm. wires/66 block
03	R/T (RU Site Type 4)	56K DDS Telco Lease Service	RCAG Shelter	30'	Two twisted pair comm. wires/66 block
04	RO (RU Site Type 4)	56K DDS Telco Lease Service	AT&T Mile 11 Shelter	N/A	Two twisted pair comm. wires/66 block
05	R/T (RU Site Type 4)	FAA Digital Radio Microwave Link	Pederson Hill Shelter	30'	Unknown
06	RO (RU Site Type 4)	56K DDS Telco Lease Service	Lemon Creek Police Station	N/A	Two twisted pair comm. wires/66 block
07	RO (RU Site Type 4)	Juneau Police Digital Radio Microwave Link	Saddle Mountain Police Shelter	30'	Unknown

Note: (1) Although located adjacent to one another, a separate communication connection is required for each GBT and each RU.

### 3.1. Alternate RU Locations

Six locations in the surveillance were initially considered as possible RU sites, but were later not selected as primary installation locations. These locations were re-classified as “Alternate” sites for a number of reasons. The six locations are listed below with a brief description of why they were not selected as primary installation locations.

- **Site A2 – R/W 26W Approach** – Lemon Creek Police Station offers better coverage for the surveillance area.
- **North Douglas Island Mile 9** – Although this site is in a good location, significant site development costs, security concerns, and better site candidates make this an alternate.
- **North Douglas JAWS Site** – Although this site is in a good location, JAWS is still in the development phase and is not a NAS facility. A geotechnical evaluation and lease issues would need to be explored.
- **Lynn Canal Firehouse** – Although this site is in a good location, significant site development costs, security concerns, and better site candidates make this an alternate.
- **Coghlan Island** – Although this site is in a good location, significant site development costs, RU blockage due to mature tree growth, limited accessibility, and better site candidates make this an alternate.
- **Battleship Island** – A very brief visual examination was conducted from a helicopter. More information would be required to evaluate this site.

While these potential RU locations were not selected as primary RU installation locations, they remain as alternates should other considerations merit multilateration subsystem configuration changes.

### 3.2. Disqualified Locations

Three locations in the surveillance area were initially considered as RU installation locations, but were disqualified for a number of reasons. The three locations are listed below with a brief description of why they were disqualified.

- **Site A3 – R/W 26W Approach** – Disqualified due to significant site development costs as well as location in relation to 26W approach restrictions and tidal estuary.
- **North Douglas Island Mile 11** – Disqualified due to significant site development costs as well as encroachment on an existing public boat launch and security issues.
- **Lena Point “Gravel Pit”** – Disqualified due to significant site development costs as well as inadequate area coverage.

## **Surveillance Area Sites**

### **3.3. GBT1 – ATCT**

RU Type	GBT
RU Installation Type	Type 4– useable shelter and useable mast
RU Installation Location	ATCT Equipment Room
RU Antenna Type	Type – Omni
Maximum RU Antenna Height	80' AGL, 102' AMSL
RU Antenna Installation Location	ATCT Roof
Antenna Coordinates	58° 21' 32.16"N, 134° 35' 2.34"W

AGL = Above Ground Level

AMSL = Above Mean Sea Level

#### **3.3.1. Existing Conditions**

The proposed GBT installation area is in the ATCT Equipment Room, located at the base of the ATCT. GBT1 is to be co-located with RU01; refer to Section 3.5 for RU 01 site preparation details. The room is accessed from the top level of the concourse. The room is small, has a concrete floor and is filled with lockers, desks, and equipment racks. It is located adjacent to the stairwell to the ATCT. There are two existing electrical panels, (RL-6 and RP-6). Both offer sufficient capacity to provide electrical power to the GBT. A Telco communication demarc panel is located in the room. The communication link for the GBT can be provided from this communications demarc. Grounding is also available in this room.

#### **3.3.2. ASDE-X Equipment Placement**

The GBT will be installed on a new minimum 19" wide X 8.56" deep wall mount rack installed above the future RU (Section 3.5). The antenna will be mounted on the parapet of the ATCT Roof (see Figures RU01A and RU01B Appendix E and Drawings WAMSS-JNU-SER-01A and WAMSS-JNU-SER-01B, Appendix D).

#### **3.3.3. FAA Site Preparation**

Site preparation tasks to be completed by the FAA prior to installation of WAM components at this site include the following:

##### **General**

- Relocate existing desk and lockers to accommodate RU and GBT installation.
- Enlarge mullion hole (min 2" diameter) in the cable access level in order to facilitate installation of the antenna cable to the ATCT Roof. In addition to the existing cables in the mullion, two 5/8" diameter RF cable and two 3/16" diameter cable will need to be installed. FAA to review structural integrity.

##### **Power**

- Install electrical conduit with requisite electrical power (15A, 120V  $\pm$  10%, 60Hz  $\pm$  5%) from power panel RL-6 or RP-6 to a L5-15R twist-lock receptacle installed within 5 feet of the future GBT installation location.

##### **Communications**

- Establish a dedicated, leased commercial Telco account for the GBT and extend communication wires (two twisted pair or four wires plus appropriate spares, if

available) from the nearby Telco interface panel to a small communication punch down block within a small junction box installed within 5 feet of the GBT installation location, or identify and reserve a path to the tagged and identified punch-down location in the Telco interface panel.

### **Grounding**

- Confirm available ground source (e.g. plate) or install a new ground plate within 15' of the GBT installation location for grounding the GBT.
- Install a ground plate (4" X 8") at the GBT antenna installation location for grounding the GBT antenna.
- The Sensis/RTSC team will make the final GBT and GBT antenna grounding connections. These connections will be made with appropriately sized (per FAA Order 6950.19A – Table 2-2: Size of Multipoint Ground System Cables) copper grounding cable. Insulated grounding cable will be used for interior grounding connections while bare copper grounding cable will be used for exterior connections.

### 3.4. GBT2 – Lena Point RCAG

RU Type	GBT
RU Installation Type	Type 4– useable shelter and useable mast
RU Installation Location	RCAG Shelter
RU Antenna Type	Type – Omni
Maximum RU Antenna Height	65' AGL, 318' AMSL
RU Antenna Installation Location	West Tower
Antenna Coordinates	58° 23' 17.46"N, 134° 45' 42.36"W

AGL = Above Ground Level

AMSL = Above Mean Sea Level

#### 3.4.1. Existing Conditions

The proposed GBT installation area is in the RCAG Shelter located at Lena Point. It is to be co-located with RU03 (refer to Section 3.7 for RU details). The shelter is accessed from a FAA owned/maintained dirt service road branching out from Lena Point Loop Road. The GBT will be located in an existing equipment rack inside the shelter. An upgrade to the fully populated existing power panel is scheduled for July 2004. This future panel can be used to provide electrical power to the GBT. A leased Telco communication demarc is located in the shelter. The communication link for the GBT can be provided from this communications demarc. Grounding is also available in this shelter.

#### 3.4.2. ASDE-X Equipment Placement

The GBT will be installed in an existing equipment rack adjacent to the future RU (Section 3.7). The antenna will be mounted on the tower located west of the RCAG shelter (see Figures RU03A and RU03B Appendix E and Drawings WAMSS-JNU-SER-03A, WAMSS-JNU-SER-03B, WAMSS-JNU-SER-03C, and WAMSS-JNU-SER-03D Appendix D).

#### 3.4.3. FAA Site Preparation

Site preparation tasks to be completed by the FAA prior to installation of WAM components at this site include the following:

##### General

- No general site preparation requirements required.

##### Power

- Install electrical conduit with requisite electrical power (15A, 120V  $\pm$  10%, 60Hz  $\pm$  5%) from future power panel to a L5-15R twist-lock receptacle installed within 5 feet of the GBT installation location.

##### Communications

- Establish a dedicated, leased commercial Telco account for the GBT and extend communication wires (two twisted pair or four wires plus appropriate spares, if available) from the nearby Telco interface panel to a small communication punch down block within a small junction box installed within 5 feet of the GBT installation location, or identify and reserve a path to the tagged and identified punch-down location in the Telco interface panel.

## **Grounding**

- Identify or install, if necessary, a grounding point at the GBT installation location for grounding the GBT.
- Identify or install, if necessary, a grounding point at the GBT antenna installation location for grounding the GBT antenna.
- The Sensis/RTSC team will make the final GBT and GBT antenna grounding connections. These connections will be made with appropriately sized (per FAA Order 6950.19A – Table 2-2: Size of Multipoint Ground System Cables) copper grounding cable. Insulated grounding cable will be used for interior grounding connections while bare copper grounding cable will be used for exterior connections.

### 3.5. RU 01 – ATCT

RU Type	RO
RU Installation Type	Type 4 – useable shelter and useable mast
RU Installation Location	ATCT Equipment Room
RU Antenna Type	Type – Omni
Maximum RU Antenna Height	80' AGL, 102' AMSL
RU Antenna Installation Location	ATCT Roof
Antenna Coordinates	58° 21' 32.16"N, 134° 35' 2.34"W

AGL = Above Ground Level

AMSL = Above Mean Sea Level

#### 3.5.1. Existing Conditions

The proposed RU installation area is in the ATCT Equipment Room, located at the base of the ATCT Tower. The room is accessed from the top level of the concourse. The room is small, has a concrete floor and is filled with lockers, desks, and equipment racks. It is located adjacent to the stairwell to the tower. There are two existing electrical panels, (RL-6 and RP-6). Both offer sufficient capacity to provide electrical power to the RU. A Telco communication demarc panel is located in the room. The communication link for the RU can be provided from this communications demarc. Grounding is also available in this room.

#### 3.5.2. ASDE-X Equipment Placement

The RU will be installed on the floor beneath a new 19" wall mount rack with a GBT installed above the RU. The antenna will be mounted on the parapet of the ATCT Roof (see Figures RU01A and RU01B Appendix E and Drawings WAMSS-JNU-SER-01A and WAMSS-JNU-SER-01B, Appendix D).

#### 3.5.3. FAA Site Preparation

Site preparation tasks to be completed by the FAA prior to installation of WAM components at this site include the following:

##### General

- Relocate existing desk and lockers to accommodate RU and GBT installation.
- Enlarge mullion hole (min 2" diameter) in the cable access level in order to facilitate installation of the antenna cable to the ATCT Roof. In addition to the existing cables in the mullion, two 5/8" diameter RF cable and two 3/16" diameter cable will need to be installed. FAA to review structural integrity.

##### Power

- Install electrical conduit with requisite electrical power (15A, 120V  $\pm$  10%, 60Hz  $\pm$  5%) from power panel RL-6 or RP-6 to a L5-15R twist-lock receptacle installed within 5 feet of the RU installation location.

##### Communications

- Establish a dedicated, leased commercial Telco account for the RU and extend communication wires (two twisted pair or four wires plus appropriate spares, if available) from the nearby Telco interface panel to a small communication punch down block within a small junction box installed within 5 feet of the RU

installation location, or identify and reserve a path to the tagged and identified punch-down location in the Telco interface panel.

### **Grounding**

- Identify or install, if necessary, a grounding point at the RU installation location for grounding the RU.
- Identify or install, if necessary, a grounding point at the RU antenna installation location for grounding the RU antenna.
- The Sensis/RTSC team will make the final RU and RU antenna grounding connections. These connections will be made with appropriately sized (per FAA Order 6950.19A – Table 2-2: Size of Multipoint Ground System Cables) copper grounding cable. Insulated grounding cable will be used for interior grounding connections while bare copper grounding cable will be used for exterior connections.

### 3.6. RU 02 – AT&T Lena Point Tower

RU Type	RO
RU Installation Type	Type 4– useable shelter and useable mast
RU Installation Location	AT&T Shelter
RU Antenna Type	Type – Omni
Maximum RU Antenna Height	210' AGL, 346' AMSL
RU Antenna Installation Location	AT&T Tower
Antenna Coordinates	58° 23' 28.50"N, 134° 46' 5.76"W

AGL = Above Ground Level

AMSL = Above Mean Sea Level

#### 3.6.1. Existing Conditions

The proposed RU installation area is in the AT&T Shelter located at Lena Point. The shelter is accessed off of Lena Point Loop Road. An existing equipment rack will be removed and the RU will be relocated in its place. Power and communications exist in the facility and will be identified by AT&T and the FAA. Grounding is also available in this room.

#### 3.6.2. ASDE-X Equipment Placement

The RU will be installed in place of an existing equipment rack in the AT&T Lena Point shelter. The antenna will be mounted on top of the AT&T communications tower (see Figures RU02A and RU02B, Appendix E, AT&T Tower Typical RF Transmission Line, Appendix F).

#### 3.6.3. FAA Site Preparation

Site preparation tasks to be completed by the FAA prior to installation of WAM components at this site include the following:

##### General

- Remove the existing rack located within 20' of the antenna cabling wall penetration to the tower.
- RF Cable installation – FAA or designee will install cable per Appendix F, "AT&T Tower Typical RF Transmission Line," however Sensis will manage the install scope.

##### Power

- Install electrical conduit with requisite electrical power (15A, 120V  $\pm$  10%, 60Hz  $\pm$  5%) from power panel to a L5-15R twist-lock receptacle installed within 5 feet of the RU installation location.

##### Communications

- Establish a dedicated, leased commercial Telco account for the RU and extend communication wires (two twisted pair or four wires plus appropriate spares, if available) from the nearby Telco interface panel to a small communication punch down block within a small junction box installed within 5 feet of the RU installation location, or identify and reserve a path to the tagged and identified punch-down location in the Telco interface panel.

##### Grounding

- Identify or install, if necessary, a grounding point at the RU installation location for grounding the RU.
- Identify and install appropriate grounding points at the RU antenna installation location for grounding the RU antenna.
- The FAA will make these connections with appropriately sized (per FAA Order 6950.19A – Table 2-2: Size of Multipoint Ground System Cables) copper grounding cable. Insulated grounding cable will be used for interior grounding connections while bare copper grounding cable will be used for exterior connections.

### 3.7. RU 03 – Lena Point RCAG

RU Type	R/T
RU Installation Type	Type 4—useable shelter and useable mast/tower
RU Installation Location	Lena Point RCAG Shelter
RU Antenna Type	Type – Omni
Maximum RU Antenna Height	65' AGL, 318' AMSL
RU Antenna Installation Location	West RCAG Tower
Antenna Coordinates	58° 23' 17.46"N, 134° 45' 42.36"W

AGL = Above Ground Level

AMSL = Above Mean Sea Level

#### 3.7.1. Existing Conditions

The proposed RU installation area is in the RCAG Shelter located at Lena Point. The shelter is accessed from a FAA dirt service road branching out from Lena Point Loop Road. The RU will be located adjacent to an existing equipment rack. An upgrade to the fully populated existing panel is scheduled for July 2004. This future panel can be used to provide electrical power to the RU. A leased Telco communication demarc is located in the room. The communication link for the RU can be provided from this communications demarc. Grounding is also available in this room.

#### 3.7.2. ASDE-X Equipment Placement

The RU will be installed adjacent to an existing equipment rack in the RCAG shelter. The antenna will be mounted on the tower located west of the RCAG shelter (see Figures RU03A and RU03B Appendix E and Drawings WAMSS-JNU-SER-03A, WAMSS-JNU-SER-03B, WAMSS-JNU-SER-03C, and WAMSS-JNU-SER-03D Appendix D.)

#### 3.7.3. FAA Site Preparation

Site preparation tasks to be completed by the FAA prior to installation of WAM components at this site include the following:

##### General

- No general site preparation requirements required.

##### Power

- Install electrical conduit with requisite electrical power (15A, 120V  $\pm$  10%, 60Hz  $\pm$  5%) from future power panel to a L5-15R twist-lock receptacle installed within 5 feet of the RU installation location.

##### Communications

- Establish a dedicated, leased commercial Telco account for the RU and extend communication wires (two twisted pair or four wires plus appropriate spares, if available) from the nearby Telco interface panel to a small communication punch down block within a small junction box installed within 5 feet of the RU installation location, or identify and reserve a path to the tagged and identified punch-down location in the Telco interface panel.

##### Grounding

- Identify or install, if necessary, a grounding point at the RU installation location for grounding the RU.

- Identify or install, if necessary, a grounding point at the RU antenna installation location for grounding the RU antenna.
- The Sensis/RTSC team will make the final RU and RU antenna grounding connections. These connections will be made with appropriately sized (per FAA Order 6950.19A – Table 2-2: Size of Multipoint Ground System Cables) copper grounding cable. Insulated grounding cable will be used for interior grounding connections while bare copper grounding cable will be used for exterior connections.

### 3.8. RU 04 – AT&T Mile 11

RU Type	RO
RU Installation Type	Type 4– useable shelter and useable mast/tower
RU Installation Location	AT&T Shelter
RU Antenna Type	Type – Omni
Maximum RU Antenna Height	180' AGL, 44' AMSL
RU Antenna Installation Location	AT&T Tower
Antenna Coordinates	58° 22' 12.12"N, 134° 36' 41.22"W

AGL = Above Ground Level

AMSL = Above Mean Sea Level

#### 3.8.1. Existing Conditions

The proposed RU installation area is in the AT&T Shelter located at Mile 11 on Route 7. The shelter is accessed off of Route 7. Two existing equipment racks will be removed and the RU will be relocated in there place. Power and communications exist in the facility and will be identified by AT&T and the FAA. Grounding is also available in this room.

#### 3.8.2. ASDE-X Equipment Placement

The RU will be installed in place of existing equipment racks in the AT&T Mile 11 shelter. The antenna will be mounted on top of the AT&T communications (see Figures RU04A and RU04B, Appendix E, AT&T Tower Typical RF Transmission Line, Appendix I).

#### 3.8.3. FAA Site Preparation

Site preparation tasks to be completed by the FAA prior to installation of WAM components at this site include the following:

##### General

- Remove the last two existing racks from the door located in the first row of racks in the AT&T shelter.
- RF Cable installation – FAA or designee will install cable per Appendix F, “AT&T Tower Typical RF Transmission Line,” however Sensis will manage the install scope.

##### Power

- Install electrical conduit with requisite electrical power (15A, 120V  $\pm$  10%, 60Hz  $\pm$  5%) from power panel to a L5-15R twist-lock receptacle installed within 5 feet of the RU installation location.

##### Communications

- Establish a dedicated, leased commercial Telco account for the RU and extend communication wires (two twisted pair or four wires plus appropriate spares, if available) from the nearby Telco interface panel to a small communication punch down block within a small junction box installed within 5 feet of the RU installation location, or identify and reserve a path to the tagged and identified punch-down location in the Telco interface panel.

##### Grounding

- Identify or install, if necessary, a grounding point at the RU installation location for grounding the RU.
- Identify or install, if necessary, a grounding point (exterior mounted) connected to the counterpoise or install ground rod at the RU antenna installation location for grounding the RU antenna.
- The FAA will make these connections with appropriately sized (per FAA Order 6950.19A – Table 2-2: Size of Multipoint Ground System Cables) copper grounding cable. Insulated grounding cable will be used for interior grounding connections while bare copper grounding cable will be used for exterior connections.

### 3.9. RU 05 – Pederson Hill

RU Type	R/T
RU Installation Type	Type 4 – useable shelter and useable mast
RU Installation Location	Pederson Hill Shelter
RU Antenna Type	Type – Omni
Maximum RU Antenna Height	60' AGL, 492' AMSL
RU Antenna Installation Location	Pederson Hill Tower
Antenna Coordinates	58° 21' 56.16"N, 134° 38' 4.38"

AGL = Above Ground Level

AMSL = Above Mean Sea Level

#### 3.9.1. Existing Conditions

The proposed RU installation area is inside the Pederson Hill Shelter located on Pederson Hill. This site is accessible by either a ½ mile hiking trail or helicopter. The shelter was inaccessible at the time of the survey, therefore power and communications information was not obtained.

#### 3.9.2. ASDE-X Equipment Placement

The RU will be installed inside the existing Pederson Hill shelter. The antenna will be mounted on the tower above the Pederson Hill shelter (see Figure RU05A Appendix E and Drawings WAMSS-JNU-SER-05A and WAMSS-JNU-SER-05B, Appendix D).

#### 3.9.3. FAA Site Preparation

Site preparation tasks to be completed by the FAA prior to installation of WAM components at this site include the following:

##### General

- No general site preparation requirements required.

##### Power

- Install electrical conduit with requisite electrical power (15A, 120V  $\pm$  10%, 60Hz  $\pm$  5%) from power panel to a L5-15R twist-lock receptacle installed within 5 feet of the RU installation location.

##### Communications

- Provide a serial conversion card installed in a MoxBox MX-2100 Digital Multiplexer Microwave interface connected by a FAA specified interface. If a additional demarc is required it should be installed within 5 feet of the RU on the shelter wall.

##### Grounding

- Identify or install, if necessary, a grounding point at the RU installation location for grounding the RU.
- Identify or install, if necessary, a grounding point at the RU antenna installation location for grounding the RU antenna.
- The Sensis/RTSC team will make the final RU and RU antenna grounding connections. These connections will be made with appropriately sized (per FAA Order 6950.19A – Table 2-2: Size of Multipoint Ground System Cables) copper

grounding cable. Insulated grounding cable will be used for interior grounding connections while bare copper grounding cable will be used for exterior connections.

**3.9.4. Saddle Mountain Link**

- Provide a serial conversion card installed in a MoxBox MX-2100 Digital Multiplexer Microwave interface connected by a FAA specified interface. This will provide a link from Saddle Mountain to Pederson Hill to the airport.

### 3.10. RU 06 – Lemon Creek Police Station

RU Type	RO
RU Installation Type	Type 4– useable shelter and useable mast/tower
RU Installation Location	Police Station Equipment Room
RU Antenna Type	Type – Omni
Maximum RU Antenna Height	35' AGL, 43' AMSL
RU Antenna Installation Location	Antenna to be mounted on existing radio mast
Antenna Coordinates	58° 21' 21.00"N, 134° 30' 28.62"W

AGL = Above Ground Level

AMSL = Above Mean Sea Level

#### 3.10.1. Existing Conditions

The proposed RU installation area is in the Lemon Creek Police Station located on Alaway Avenue. Space is available for the RU, however, a location for the RU was not identified during the survey. The FAA and Juneau Police will determine the location at a later date. Power and communications exist in the facility and will be identified by the FAA and Juneau Police. Grounding is also available in this room.

#### 3.10.2. ASDE-X Equipment Placement

The RU will be installed in an FAA/Juneau police identified location. The antenna will be mounted on top of the existing mast on top of the Lemon Creek Police Station (see Figure RU06A Appendix E).

#### 3.10.3. FAA Site Preparation

Site preparation tasks to be completed by the FAA prior to installation of WAM components at this site include the following:

##### General

- Exact position was not defined during the SES. The FAA should work with police officials to define the exact location for the future RU.

##### Power

- Install electrical conduit with requisite electrical power (15A, 120V  $\pm$  10%, 60Hz  $\pm$  5%) from power panel to a L5-15R twist-lock receptacle installed within 5 feet of the RU installation location.

##### Communications

- Establish a dedicated, leased commercial Telco account for the RU and extend communication wires (two twisted pair or four wires plus appropriate spares, if available) from the nearby Telco interface panel to a small communication punch down block within a small junction box installed within 5 feet of the RU installation location, or identify and reserve a path to the tagged and identified punch-down location in the Telco interface panel.

##### Grounding

- Identify or install, if necessary, a grounding point at the RU installation location for grounding the RU.
- Identify or install, if necessary, a grounding point at the RU antenna installation location for grounding the RU antenna.

- The Sensis/RTSC team will make the final RU and RU antenna grounding connections. These connections will be made with appropriately sized (per FAA Order 6950.19A – Table 2-2: Size of Multipoint Ground System Cables) copper grounding cable. Insulated grounding cable will be used for interior grounding connections while bare copper grounding cable will be used for exterior connections.

### 3.11. RU 07 – Saddle Mountain Police Radio Site

RU Type	RO
RU Installation Type	Type 4– useable shelter and useable mast/tower
RU Installation Location	Saddle Mountain Shelter
RU Antenna Type	Type – Omni
Maximum RU Antenna Height	45’ AGL, 3135’ AMSL
RU Antenna Installation Location	Antenna to be mounted on existing mast
Antenna Coordinates	58° 17’ 51.18”N, 134° 30’ 40.32”W

AGL = Above Ground Level

AMSL = Above Mean Sea Level

#### 3.11.1. Existing Conditions

The proposed RU installation area is in the Saddle Mountain Police Radio Site located on Saddle Mountain. This site is only accessible by helicopter. The RU will be located in place of existing equipment (the existing equipment will need to be suspended from the ceiling. An existing 100A Square D power panel inside the shelter has four knockouts available. An existing microwave connection exists between the radio site and the Lemon Creek Police Station. Grounding is also available in this room.

#### 3.11.2. ASDE-X Equipment Placement

The RU will be installed in an FAA/Juneau police shelter on Saddle Mountain. The antenna will be mounted on top of the existing mast on top of the Saddle Mountain Shelter (see Figures RU07A and RU07B Appendix E and Drawing WAMSS-JNU-SER-07A Appendix D).

#### 3.11.3. FAA Site Preparation

Site preparation tasks to be completed by the FAA prior to installation of WAM components at this site include the following:

##### General

- Relocate existing equipment.

##### Power

- Install electrical conduit with requisite electrical power (15A, 120V  $\pm$  10%, 60Hz  $\pm$  5%) from power panel to a L5-15R twist-lock receptacle installed within 5 feet of the RU installation location.

##### Communications

- Provide a serial card installed in a MoxBox MX-2100 Digital Multiplexer Microwave interface connected via Category 5E cable to a RJ45 jack located within a small junction box installed on the shelter wall within 5 feet of the RU installation location.

##### Grounding

- Identify or install, if necessary, a grounding point at the RU installation location for grounding the RU.
- Identify or install, if necessary, a grounding point at the RU antenna installation location for grounding the RU antenna.
- The Sensis/RTSC team will make the final RU and RU antenna grounding

connections. These connections will be made with appropriately sized (per FAA Order 6950.19A – Table 2-2: Size of Multipoint Ground System Cables) copper grounding cable. Insulated grounding cable will be used for interior grounding connections while bare copper grounding cable will be used for exterior connections.

**Appendix A:**  
**“ASDE-X System Constraints Table”, Sensis Doc. No. 830-009924, Version 7**

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Quality Management System

# ***ASDE-X System Installation Constraints Table***

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9 June 2004**

**Doc. No. 830-009924**

**Part of CDRL D007**

**Contract #:  
DTFA01-01-C-00011**

**Prepared For:**

Federal Aviation Administration  
800 Independence Ave., S.W.  
Washington, DC 20591

 **Sensis**  
CORPORATION  
5793 Widewaters Parkway  
DeWitt, New York 13214  
(315) 445-0550  
FAX: (315) 445-9401  
CAGE Code: 1EG52  
*Detect the Difference*

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1	11/13/2002	J. Biedermann	All	Document creation
2	1/07/2003	A. Fairbank	All	Revision
3	02/24/2003	A. Fairbank/D. Michel	-	Revised interconnect
4	07/17/2003	D. Michel	All	Updated equipment weight & pictures; various corrections
5	01/28/2004	S. Wilson	All	Reformatted document, updated photos, added enhancements & options
6	04/01/2004	S. Wilson	All	Clarified box dimensions, corrected cabinet current ratings, added enhancements
7	06/09/2004	S. Wilson	All	Added Isolation Transformer, Added SMR Maintenance Display, Revised Cable lengths, Updated equipment weights and power

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## 1.0 BASELINE CONFIGURATION CONSTRAINTS




### 1.1 System Constraints




ASDE-X System Hardware Configuration Item (HWCI)	Quantity in ASDE-X Baseline Production CLIN	ASDE-X Baseline System Constraint
Processor Cabinet	1	1
Communications Cabinet	1	1
Display Processor Cabinet	1	3
Tower Display Unit	3	12
RMS Cabinet	1	1
RMS Workstation	1	1
SMR Antenna System	1	1
Remote Units	3	16
Reference Transmitters	1	8
ASR-9 Interface	1	2
ARTS-IIIA/IIIE Interface	1	1
Training Display Unit	1	1



## 1.2 Baseline configuration components & installation constraints



Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	Multilateration Receive Only Remote Unit (RO)	24x17x40 (with 1 foot stand)  Unit height with optional 2 foot stand will be 52"	150	<2.5A/120V 500W Heater Off  <6.7A/120V 500W Heater On	<1.02 Max 500W heater Off  <2.7 Max 500W Heater On	RF Coaxial Cable; Sector or Omni Antenna; CSU/DSU Modem; AC Power	Multiple Airfield Sites (Indoor or Outdoor)
	Multilateration Receive Transmit Remote Unit (RT)	24x17x40 (with 1 foot stand)  Unit height with optional 2 foot stand will be 52"	160	<2.5A/120V 500W Heater Off  <6.7A/120V 500W Heater On	<1.02 Max 500W heater Off  <2.7 Max 500W Heater On	RF Coaxial Cable; Sector or Omni Antenna; CSU/DSU Modem; AC Power	Multiple Airfield Sites (Indoor or Outdoor)
	Multilateration Reference Transmitter (RX)	24x17x40 (with 1 foot stand)  Unit height with optional 2 foot stand will be 52"	130	<2.3A/120V	<0.94 Max	2 RF Coaxial Cables;  2 Antennas  AC Power	Multiple Airfield Sites (Indoor or Outdoor)
	Multilateration Sector Antenna	19x15.25x5.6	4	N/A	N/A	RF Coaxial Cable	Co-located with Remote Units

Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	Multilateration Omni Antenna	6.5 dia.x20.1	7.0	N/A	N/A	RF Coaxial Cable	Co-located with Remote Units
	Antenna	291x26x11	180	NA	N/A	N/A	ATC Tower Roof or Remote Tower
	Pedestal Assembly w/ COTS Stand	27.6x36x 39.6	890	21A/208V 3 Phase	N/A	RF Out; Encoder Out; Oil Level Sensor Out; Temp. Sensor Out; AC Power In	ATC Tower Roof or Remote Tower
	Pedestal Assembly w/ COTS Stand and .5M extension	27.6x36x 61.4	1093				
	Pedestal Assembly w/ COTS Stand and 1M extension	27.6x36x 81.1	1334				
	Pedestal Assembly w/ COTS Stand and 1.5M extension	27.6x36x 100.8	1391				
	Motor Controller	23.5x17x25.5	75	N/A	0.5	AC Power In; Interlocks In; Oil Level Sensor In; RDP Status In; AC Power Out; Motor Controller Status; Compressor Status;	ATC Tower Equipment Room






Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	Dehydrator / Compressor	19x14x7.3	42	2.16A/120V	0.9	AC Power In Status Out Air Hose Out	ATC Tower Equipment Room
	Transceiver Cabinet	28x36x70	805	15.3A/120V Per Circuit 30.6A Total	12.54	RF In; Encoder In; AC Power In; RDP Status In; Composite Video Out; +28 VDC Out; Transceiver Status/Control  Rear of cabinet must be more than 6 inches from wall	ATC Tower Equipment Room
	Radar Data Processor Cabinet (RDP)	22.1x36x48	600	5.8A/120V Per Circuit 11.6A Total	4.77	LAN; AC Power In; Motor Controller Status In; Composite Video In; Transceiver Status/ Control	ATC Tower Equipment Room





Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	GPS Antenna (2 required)	4.4 dia.x3.75	0.6	N/A	N/A	RF Coaxial Cable	ATC Tower Roof or Remote Tower
	System Interface Unit (SIU-2)	19x8.6x5.25	11.5	<1.4A/120V	0.57	AC Power In; Serial In; Serial Out	ASR-9 Equipment Room
	Processor Cabinet (Processor)	24x29x72	475	7.6A/120V Circuit A 7.6A/120V Circuit B 15.2A Total  20 A/120V Circuit C	6.22	LAN; AC Power In; Coax (GPS) POTS Telco (RMMS)	ATC Tower Equipment Room



Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	Communication Cabinet (Comm)	24x29x72	505	4.7A/120V Circuit A  4.6A/120V Circuit B  9.3A Total  20 A/120V Circuit C	3.82	LAN; DSU/CSU; RS-422 (ASR-9); AC Power  Barometric Pressure Meter: 1/4 inch plastic tubing	ATC Tower Equipment Room
	Remote Monitoring System Cabinet (RMS)	24x29x72	485	18.3A/120V Circuit A  6.0A/120V Circuit B  24.3A Total  20 A/120V Circuit C	9.96	LAN; AC Power In  <u>RMS</u> Video PS2 keyboard PS2 mouse AC power in  <u>MDT</u> Video USB keyboard USB mouse AC power in	ATC Tower Equipment Room

Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	RMS Workstation	50x30x76	115	6.0A/120V	2.46	<u>RMS</u> Video PS2 keyboard PS2 mouse AC power in  <u>MDT</u> Video USB keyboard USB mouse AC power in	ATC Tower Equipment Room
	Display Processor Cabinet (DP) (1 Cabinet required per 4 Displays)	24x29x86	520	13.0A/120V Circuit A  13.0A/120V Circuit B  26.0A Total   20 A/120V Circuit C	10.65	LAN; Fiber Optic Video Out; AC Power In	ATC Tower Equipment Room

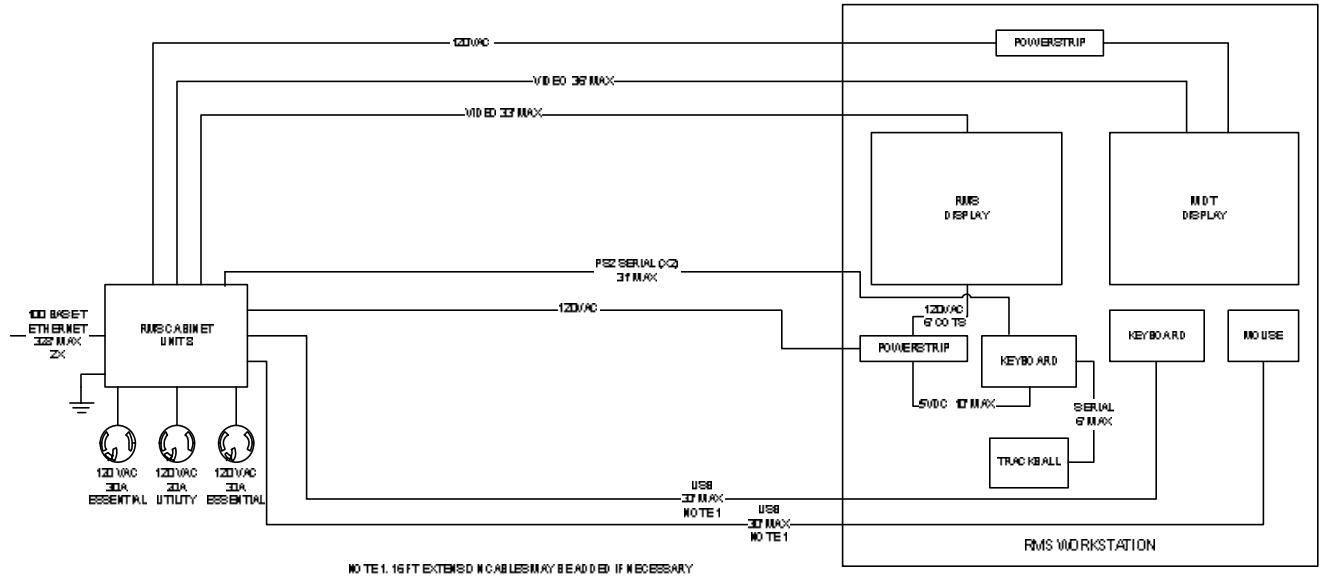
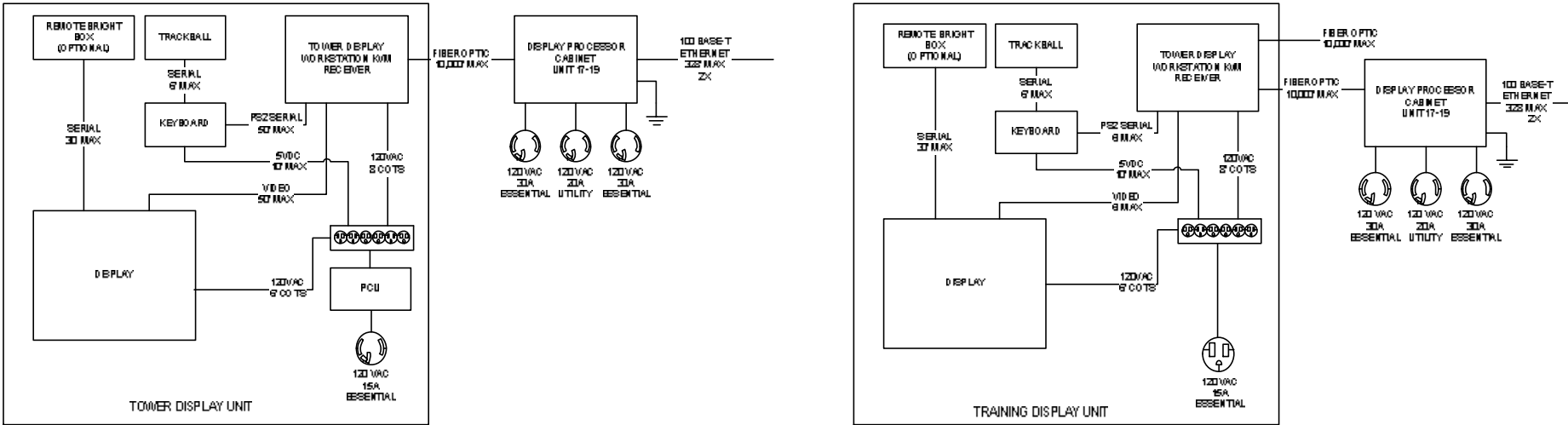
Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	Display Monitor	19.5x5.4x17	40	4A/120V	1.6	Video In; Serial In; AC Power In	ATC Tower  Current mounting is desktop swivel mount
	Display Keyboard	12.8x6.7x2	<5	0.1A/120V	0.04	IBM PS2 / Serial Out	ATC Tower
	Display Keypad/Trackball	9x6x3	<5	0.1A/120V	N/A	Serial Out	ATC Tower
	Display Remote Brightness Box	3.0x2.7x1.5	1	N/A	N/A	Serial Out	ATC Tower
	Display Remote Brightness Box Flush Mount	2.8x3.5x4.5	1	N/A	N/A	Serial Out	ATC Tower

Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	Display Power Conditioning Unit	8.3x12.0x4.3	20	0.6A/120V	0.25	AC Power In; AC Power Out	ATC Tower
	KVM Extender Receiver	16.6x16x1.75	11	0.2A/120V	<0.08	Optic Video In; AC Power In; RF Video Out; Serial Out	ATC Tower
	Stow Pin Interlock	15.5x8.0x2.5	4	N/A	N/A	24 VDC In	ATC Tower
	Cab Safety Interlock	1.75x1.75x3.50	<2	N/A	N/A	24 VDC In	ATC Tower
	Equipment Room Safety Interlock	3.75x3.75x3.00	<2	N/A	N/A	24 VDC In	ATC Tower

Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	Door/Hatch Interlock	4x4x6	<2	N/A	N/A	24 VDC In	ATC Tower
	Interlock Terminal Board Assembly	16x7x20	25	N/A	N/A	24 VDC In	ATC Tower
	Desktop Swivel Mount	24x16x12	25	N/A	N/A	N/A	ATC Tower
	GPS Surge Protection Box	16x7x20	25	N/A	N/A	Coax; Ground	ATC Tower




Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	SMR Surge Protection Box	16x7x20	25	N/A	N/A	24 VDC; Serial; Ground	ATC Tower
	RF Surge Arrestor Box	10x5x12	20	N/A	N/A	Coax; Ground	Various



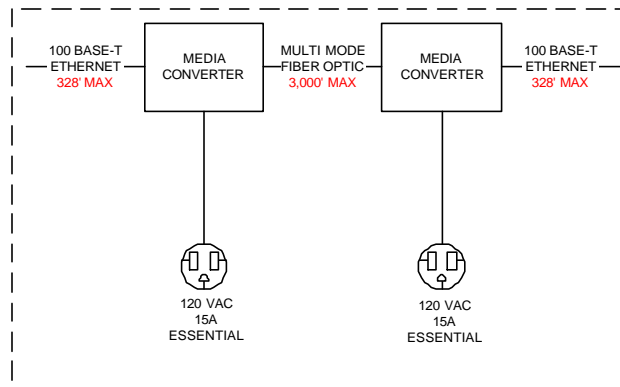


## 2.0 APPROVED SYSTEM ENHANCEMENTS

### 2.1 Ethernet Media Conversion

Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	Media Converter (2 Required)	5x5x1.75	<2	N/A	N/A	LAN; Fiber Optic; 120 VAC	ATC TOWER
	Cantilever Shelf	17.5x12.0x3.50	5	N/A	N/A	N/A	ATC TOWER
	Wall Mount Shelf	12.5x20.3x10.0	8	N/A	N/A	N/A	ATC TOWER

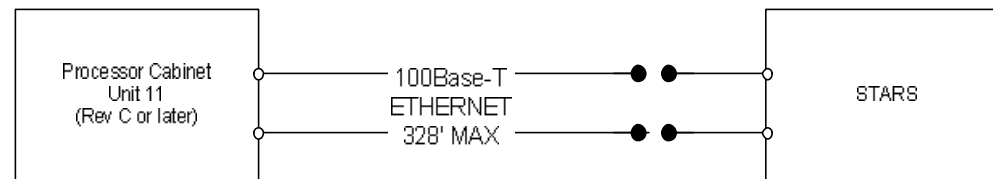
### Ethernet Media Block Diagram



## 2.2 STARS Interface

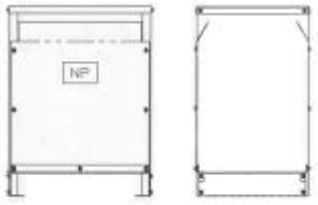
Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
No External Hardware Changes							

### STARS Interface Block Diagram

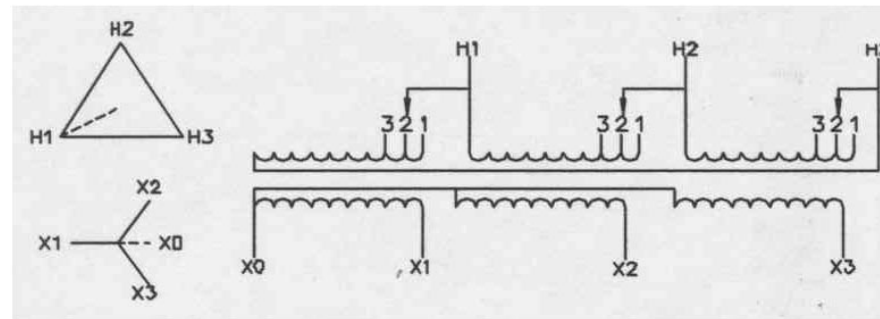


### 3.0 GFE OPTIONS

#### 3.1 Isolation Transformer (TBD)

Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	Isolation Transformer	20x16x27	200	N/A	3.5	Primary Power 208 VAC	Co-located with Motor Controller


#### Isolation Transformer Block Diagram



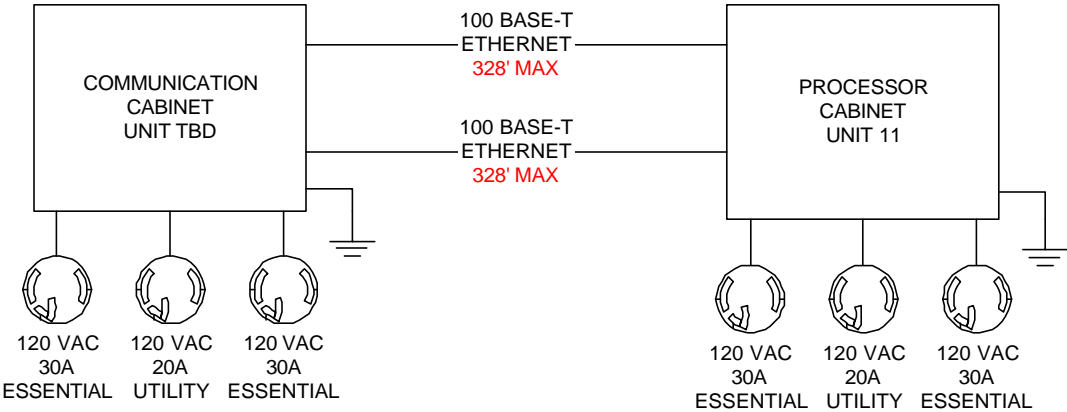
## 4.0 PRELIMINARY SYSTEM ENHANCEMENT DATA

The information contained in this section is preliminary and is subject to change as the design evolves.


### 4.1 32 RU

Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	Communication Cabinet (Comm)	24x29x72	505	4.7A/120V Circuit A  4.6A/120V Circuit B  9.3A Total  15 A/120V Circuit C	3.82	LAN; DSU/CSU;  AC Power	ATC Tower Equipment Room

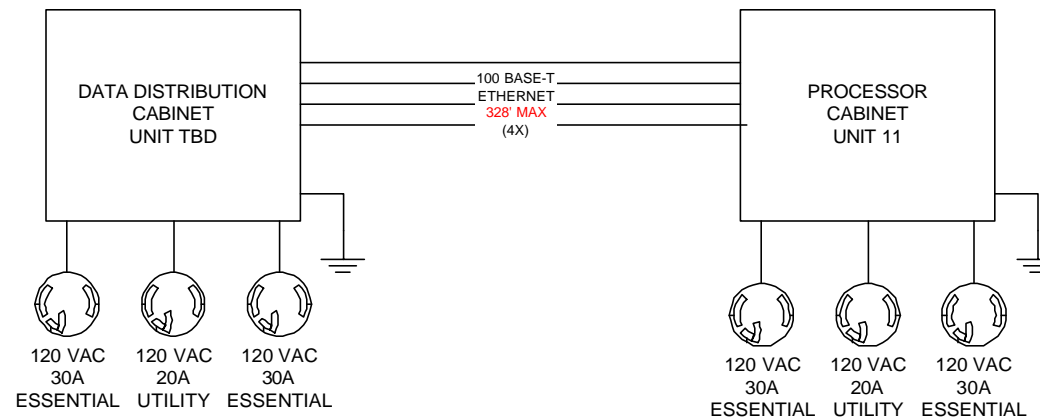
32 RU Block Diagram





## 4.2 Data Distribution

Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	Data Distribution Cabinet	24x29x72	329 (est)	1.8A/120V Circuit A  1.8A/120V Circuit B  3.6A Total   20 A/120V Circuit C	TBD	120 VAC; Ethernet	ATC Tower Equipment Room

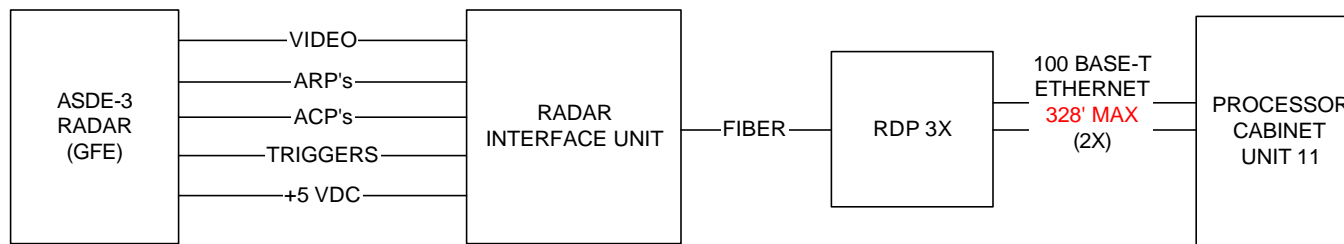
### Data Distribution Block Diagram





### 4.3 ASDE 3X



Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	Radar Interface Unit	19x14x5.25	<25	2.6A/5V	TBD	+5VDC; Trigger; ACP, ARP, Video; Fiber Optic	ATC Tower
	Radar Data Processor Cabinet	24x36x72	403	TBD	TBD		ATC Tower

## ASDE 3X Interface Block Diagram

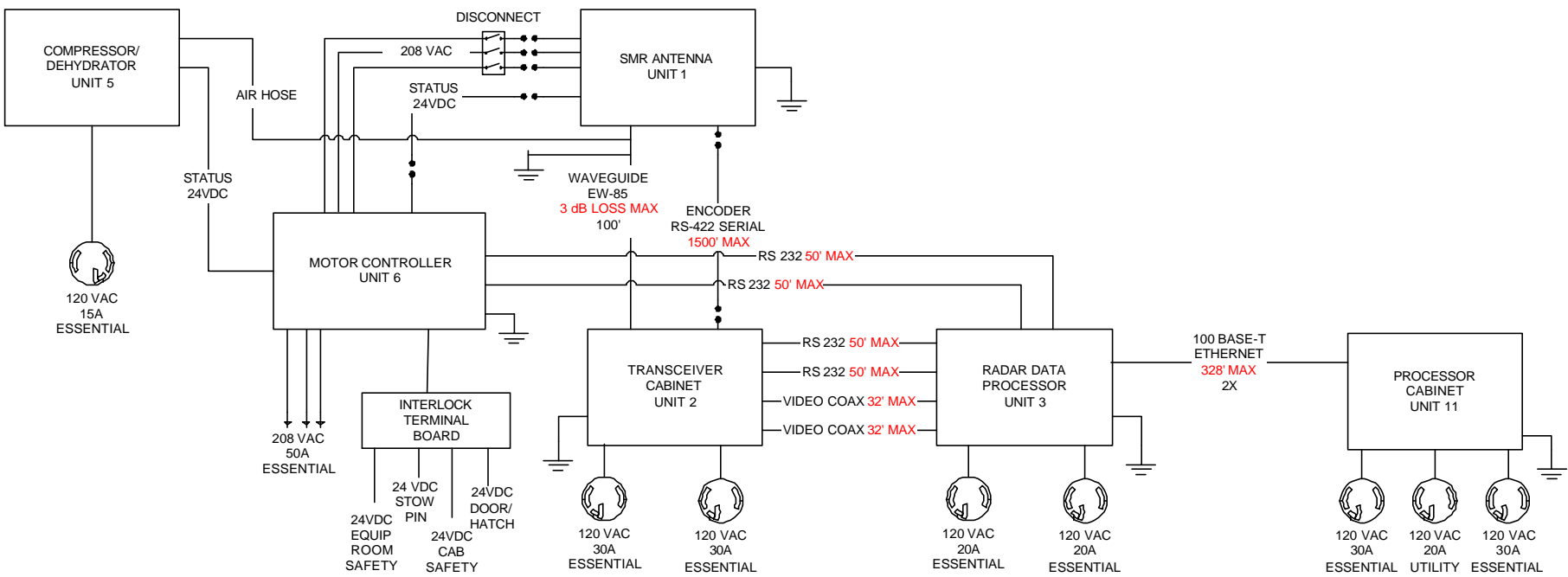


#### 4.4 SMRi



Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
Drawing TBD	SMRi Antenna	Antenna; 323x24x14  Pedestal 53 high	1100	21A/208VAC	N/A	RF Out; Encoder Out; Oil Level Sensor Out; Temp. Sensor Out; AC Power In	ATC Tower Roof or Remote Tower
	Motor Controller	23.5x17x25.5	75	N/A	0.5	AC Power In; Interlocks In; Oil Level Sensor In; RDP Status In; AC Power Out; Motor Controller Status; Compressor Status;	ATC Tower Equipment Room
	Dehydrator / Compressor	19x14x7.3	42	2.16A/120V	0.9	AC Power In Status Out Air Hose Out	ATC Tower Equipment Room

Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	Transceiver Cabinet	75x35x30.3	TBD	TBD	TBD	TBD	ATC Tower Equipment Room
	Radar Data Processor Cabinet (RDP)	24x36x72	544	TBD	TBD	TBD	ATC Tower Equipment Room

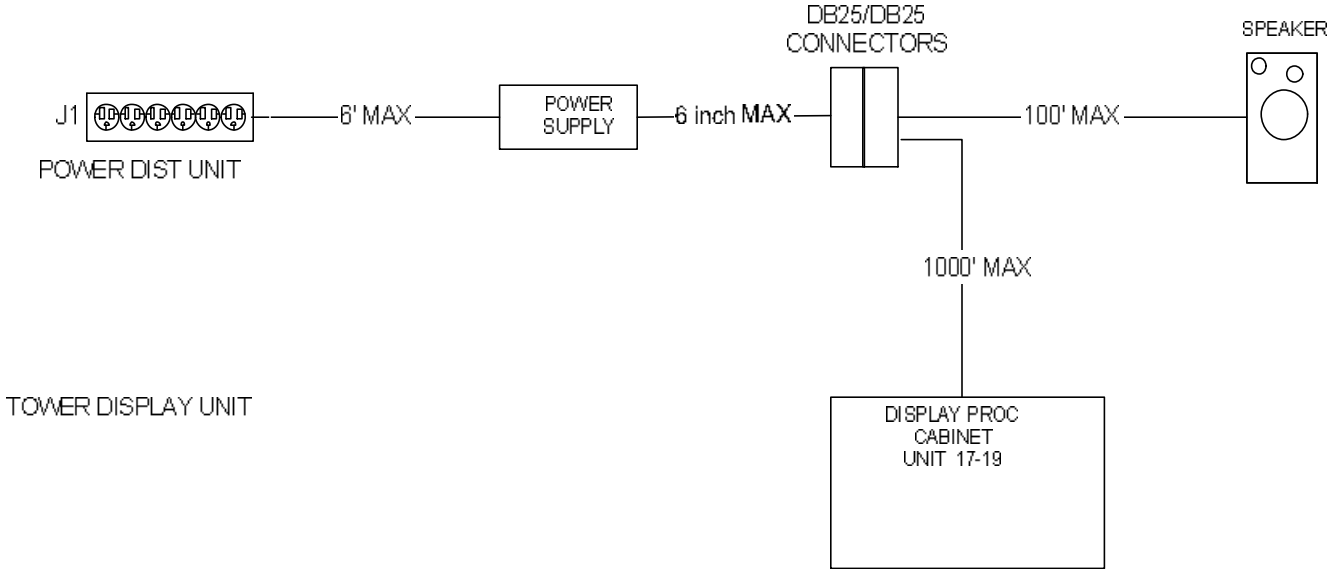
SMRi Interface Block Diagram



## 4.5 Safety Logic

Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	Speaker	7.5x5x5	<25	N/A	N/A	Audio; Power In	ATC Tower
	Power Supply	2.5x5x1.25	<1	<100 W	N/A	N/A	ATC Tower

Safety Logic Block Diagram



#### 4.6 Remote SMR

Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD





#### Remote SMR Block Diagram


#### 4.7 Multi Radar

Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

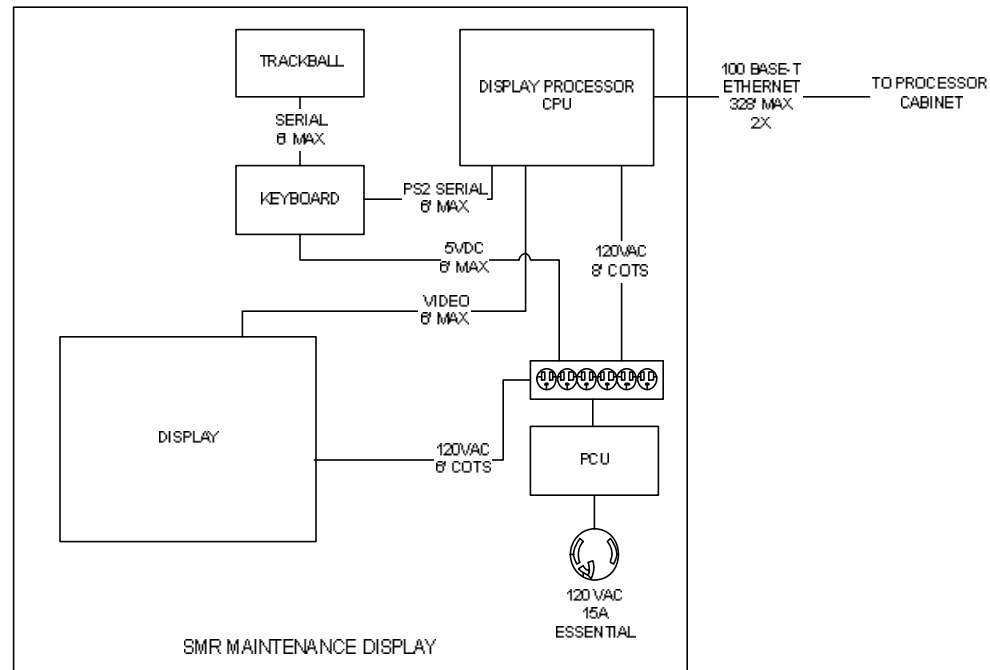
#### Multi Radar Block Diagram

## 4.8 SMR Maintenance Display

Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	Display Monitor	19.5x5.4x17	40	4A/120V	1.6	Video In; Serial In; AC Power In	TBD
	Display Keyboard	12.8x6.7x2	<5	0.1A/120V	0.04	IBM PS2 / Serial Out	TBD
	Display Power Conditioning Unit	8.3x12.0x4.3	20	0.6A/120V	0.25	AC Power In; AC Power Out	TBD
	Display Keypad/Trackball	9x6x3	<5	0.1A/120V	N/A	Serial Out	TBD

Subsystem Component	Name	Unit Size (inches) (W x D x H)	Unit Weight (pounds)	Max. Power Usage (Amps/Volts)	Thermal Load KBtu/Hr	Unit Interconnection Options	Proposed Installation Location
	Display Processor	8.5x20x17.5	44	TBD	TBD	Video Out; LAN; AC Power In; Keyboard, Mouse	TBD

### SMR Maintenance Display Block Diagram



**Appendix B:**  
**“Juneau, Alaska Wide Area Multilateration (WAM) Siting Analysis”, Doc. No. 840-012199, Version: 2, Date: 6/24/04**

# **Juneau, Alaska Wide Area Multilateration (WAM) Siting Analysis**

**Document No.: 840-012199  
Version: 2  
6/24/04**

**Prepared for:**

**FAA  
Alaskan Regional Office**

**Prepared by:**



**5793 Widewaters Parkway  
DeWitt, New York 13214 USA  
(315) 445-0550  
FAX: (315) 445-9401  
CAGE Code: 1EG52**

*Detect the Difference*

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Quality Management System

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V1	5/5/04	Chris Przybyla	All	Initial release
V2	6/24/04	Chris Przybyla	All	Initial release

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## 1. Location Selection

### 1.2 Recommended Remote Unit (RU) Locations

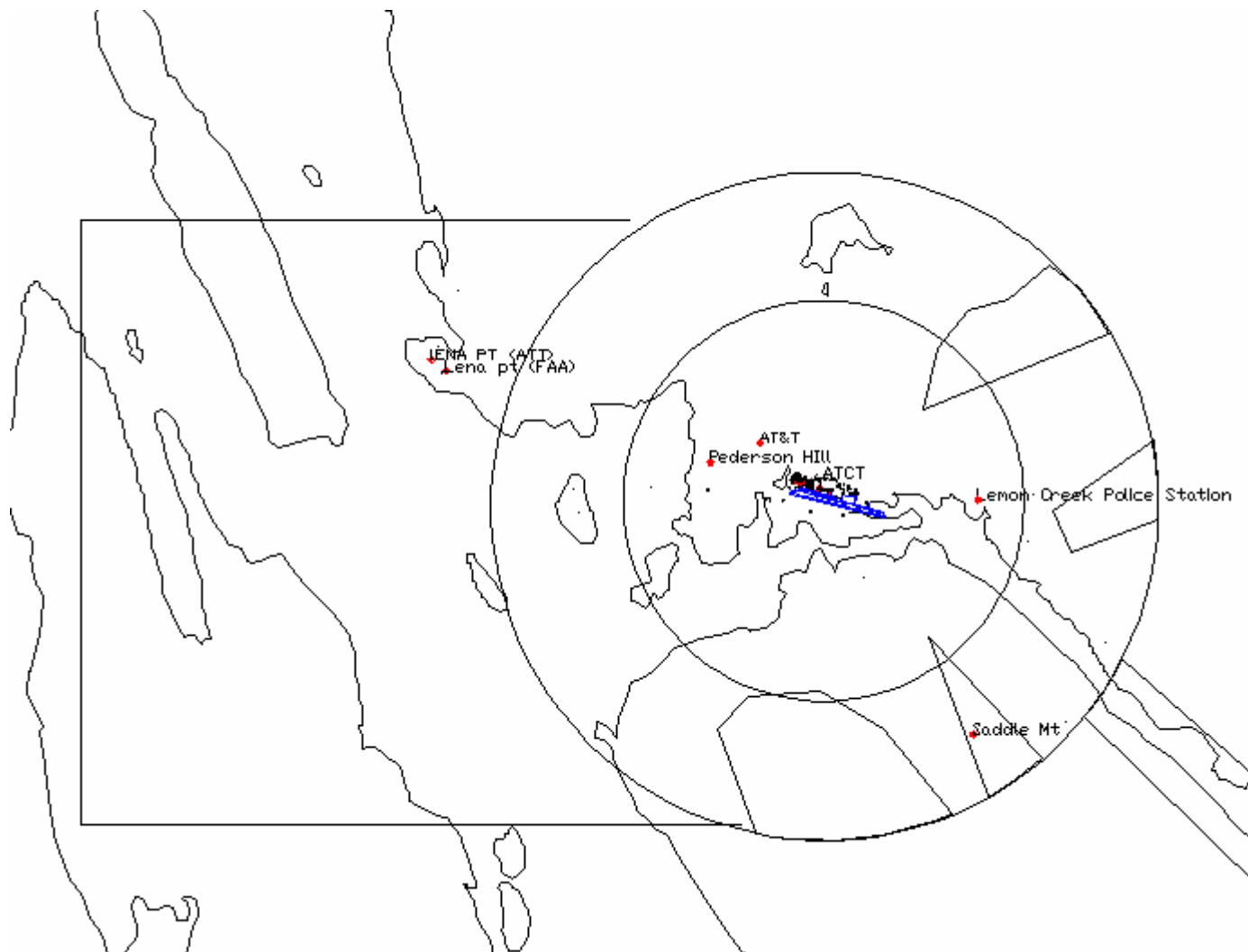


Figure 1 – Candidate Remote Unit (RU) Installation Sites

**Table 1 – Proposed ASDE-X Assembly Locations**

<b>ID</b>	<b>Site</b>	<b>Type</b>	<b>Lat (D/M/S)</b>	<b>Lon (D/M/S)</b>
1	ATCT	RO	58 21 31.54	134 34 59.18
2	Lena Point AT&T	RO	58 21 34.5	134 46 01.1
3	Lena Point FAA	R/T	58 23 19.2	134 45 35.5
4	AT&T	RO	58 22 13.6	134 36 39.8
5	Pederson Hill	R/T	58 21 10.53	134 33 10.49
6	Lemon Creek Police Station	RO	58 21 21	134 30 28.62
7	Saddle Mountain Police Radio Site	RO	58 17 51.18	134 30 40.32

## 2. Analysis Details

### 2.2 Multilateration Coverage

500ft AGL: 99.3% below a precision value of 200ft.

2000ft AMSL: 99.8% below a precision value of 200ft.

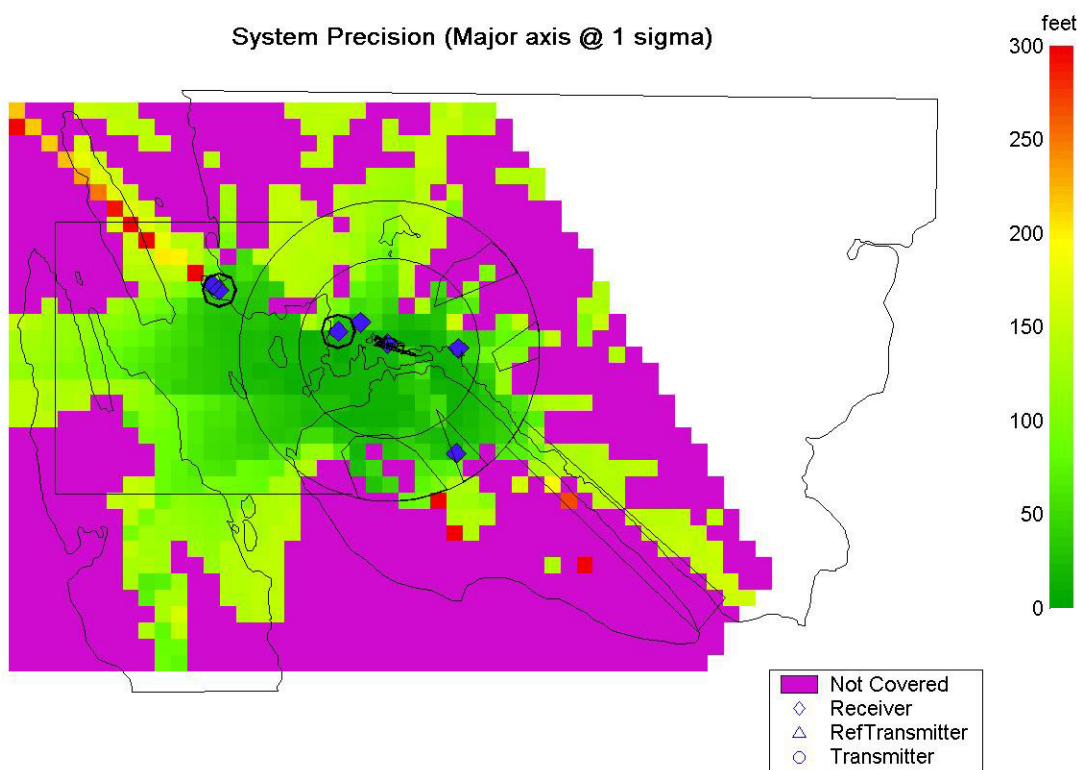


Figure 2 – 500ft AGL

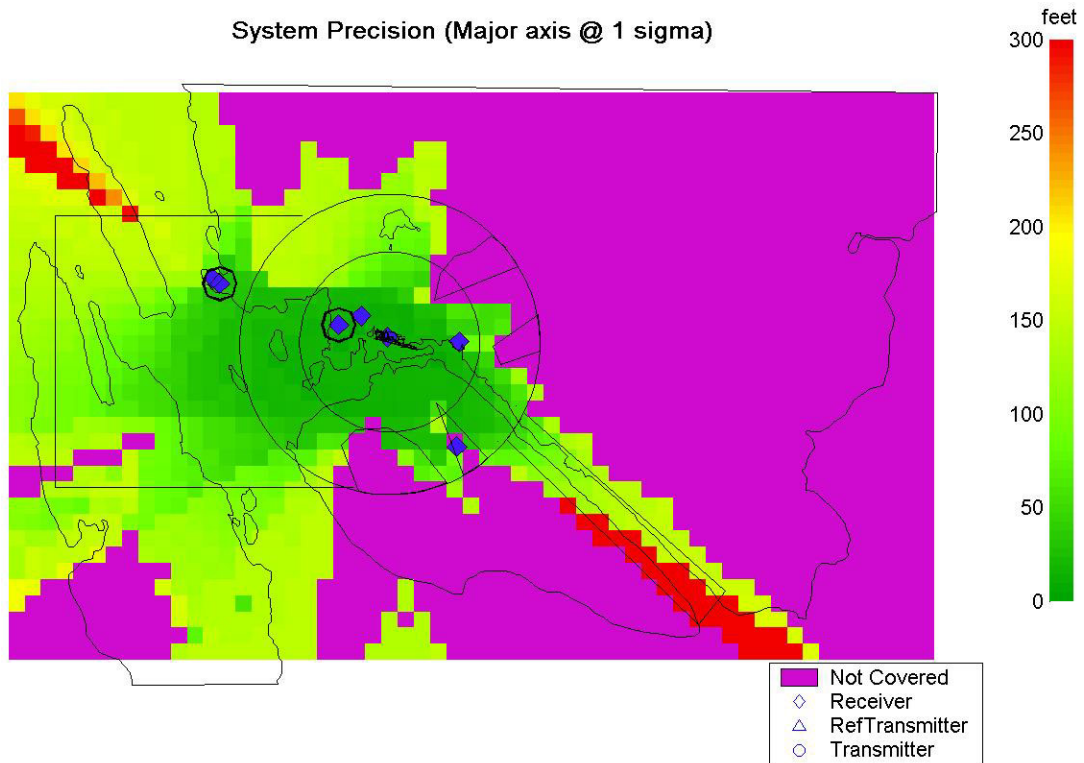


Figure 3 – 2000ft AMSL

## 2.2.2 Individual RU Coverage

### 2.2.1.1 Receive RU Coverage 500ft AGL

The following plots summarize the coverage for each of the RUs on an individual basis and indicate the type of RU, namely a Receiver/Transmitter (RT) or a Receive-only (RO) unit. Figure 4 through Figure 10 depict the coverage area included in the RU's detectable region for each RU proposed. This coverage will be confirmed visually where possible during a site survey.

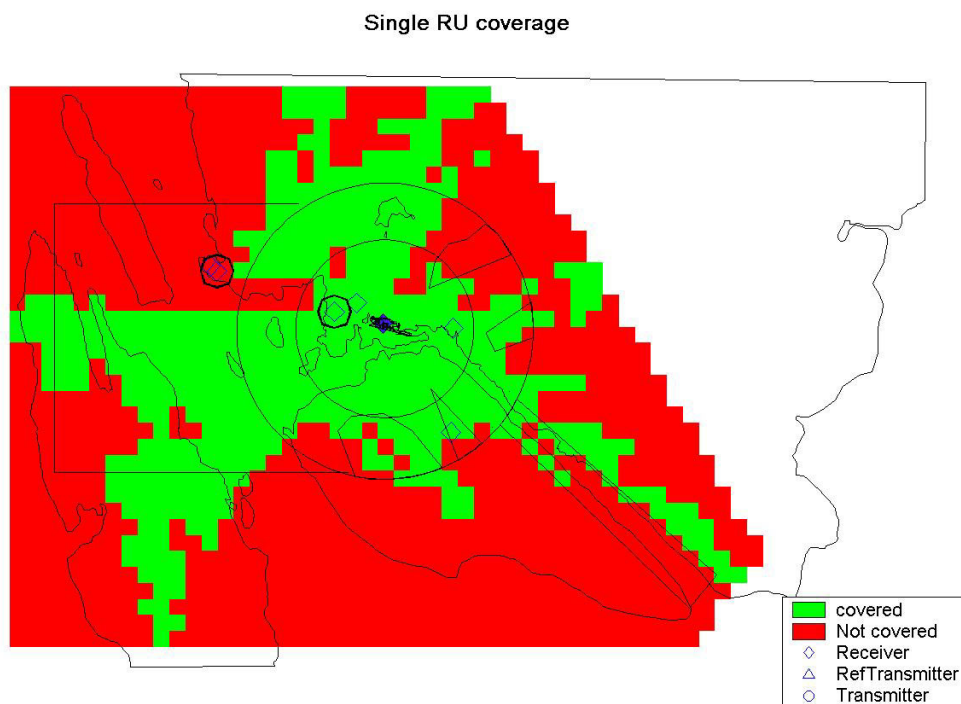


Figure 4 – ATCT

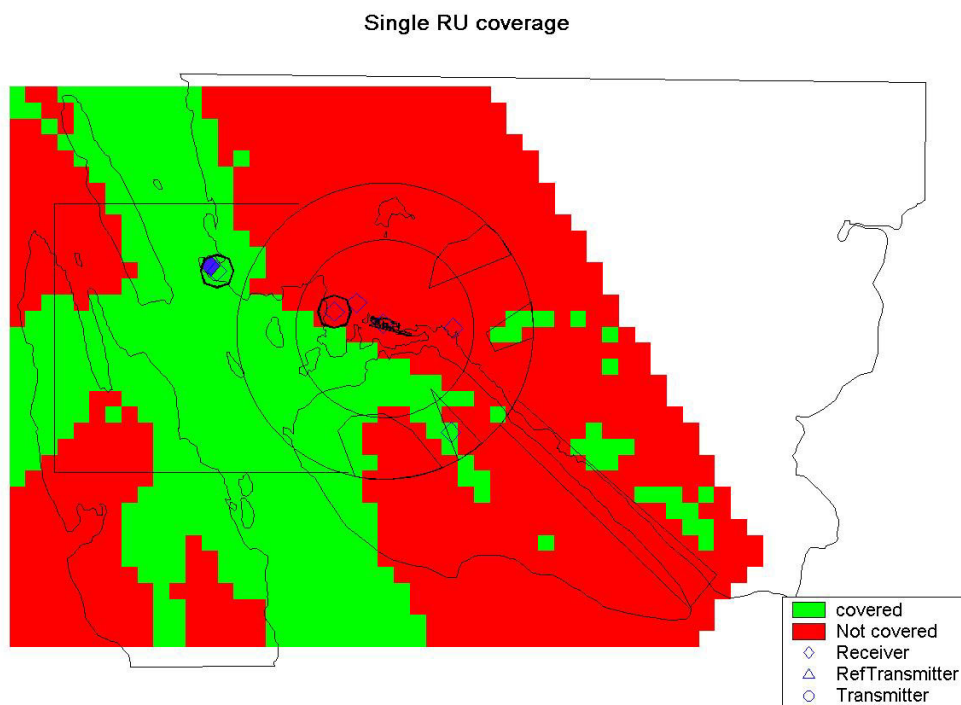


Figure 5 – AT&T Lena Point Tower

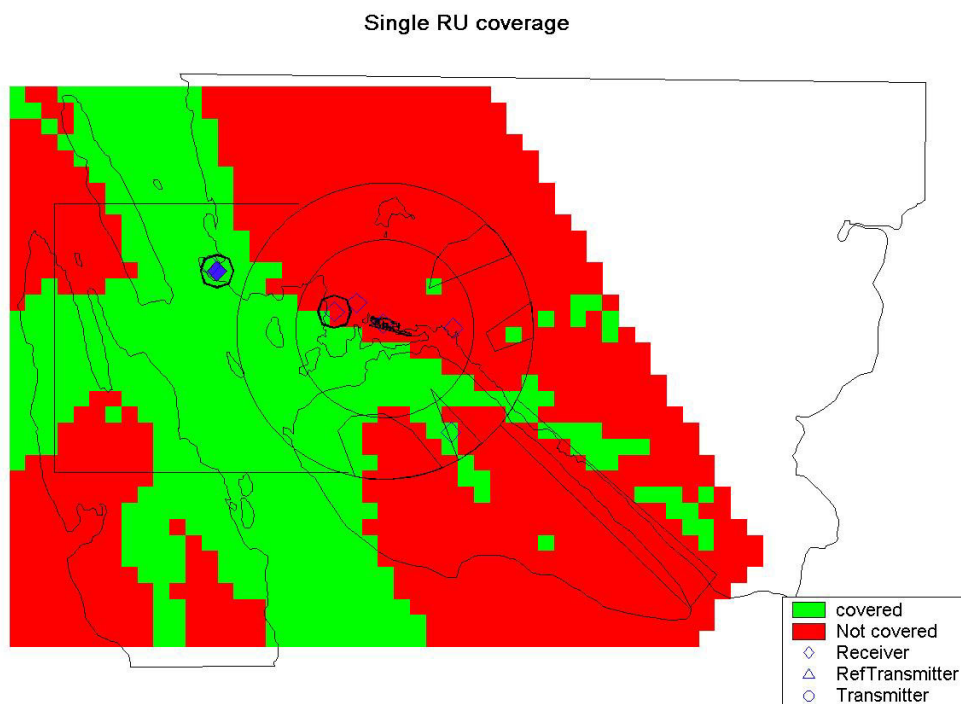


Figure 6 – Lena Point FAA RCAG Site

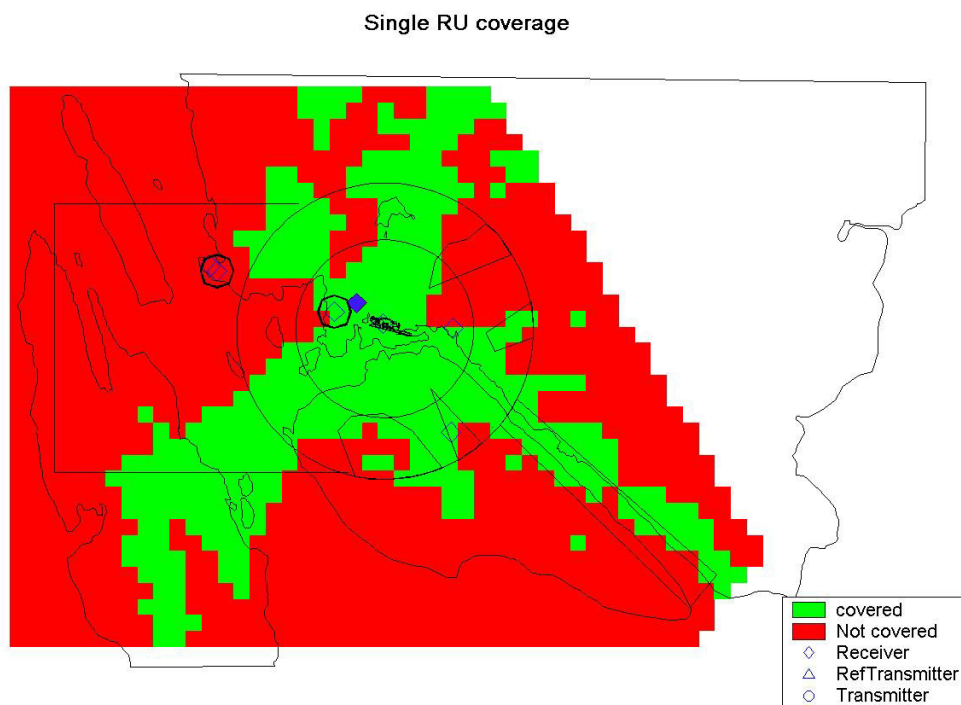


Figure 7 – AT&T Mile 11 Tower Site

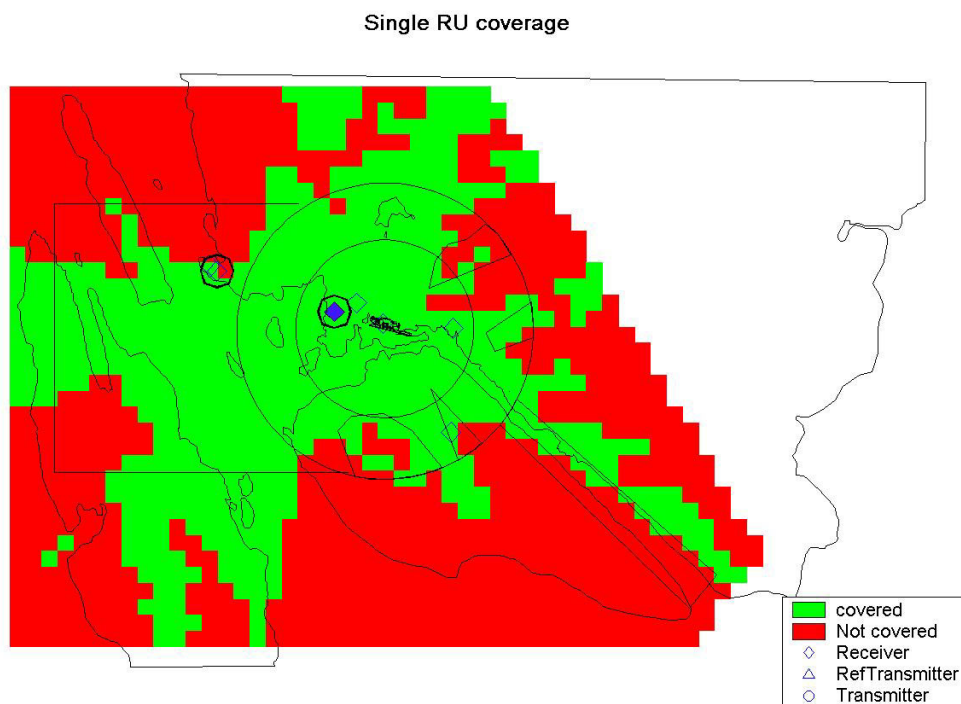


Figure 8 – Peterson Hill

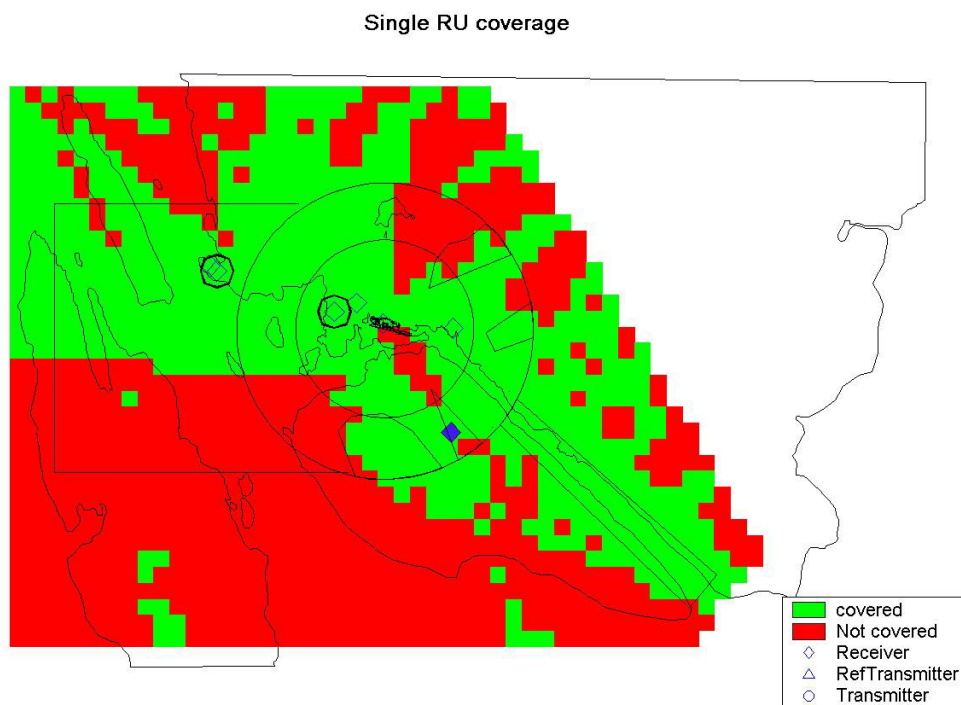
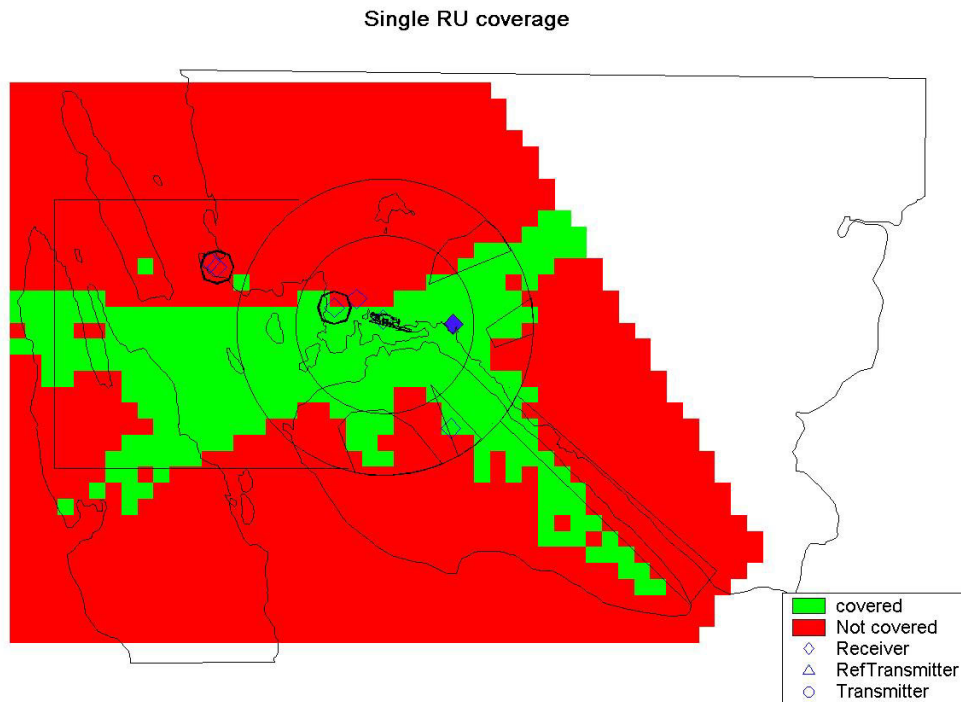


Figure 9 – Lemon Creek Police Station



**Figure 10 – Saddle Mountain Police Radio Site**

**2.2.1.2 Receive RU Coverage 2000ft AMSL**

The following plots summarize the coverage for each of the RUs on an individual basis and indicate the type of RU, namely a Receiver/Transmitter (RT) or a Receive-only (RO) unit. Figure 11 through Figure 17 depict the coverage area included in the RU's detectable region for each RU proposed. This coverage will be confirmed visually where possible during a site survey

Single RU coverage

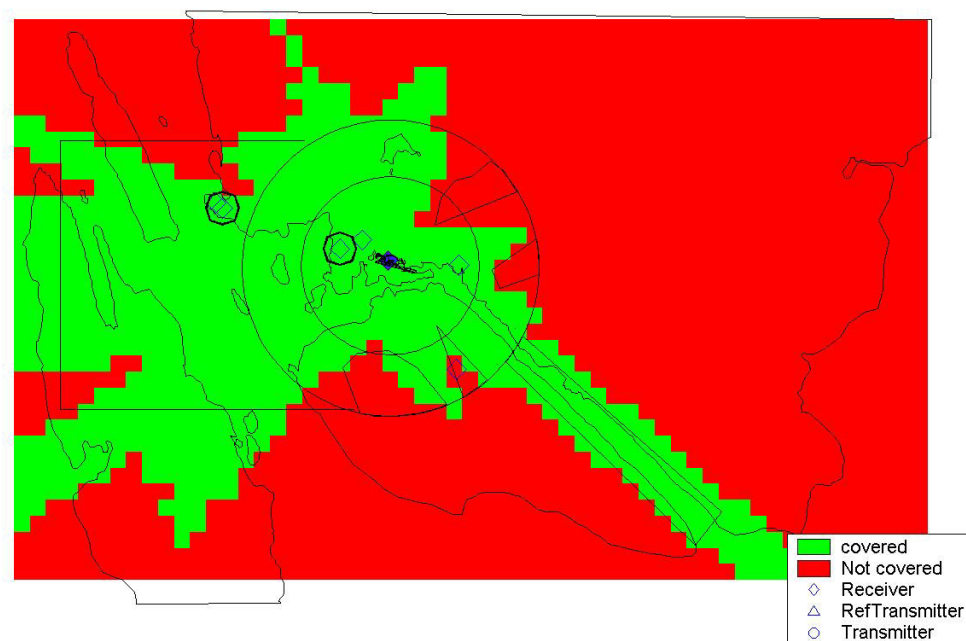


Figure 11 – ATCT

Single RU coverage

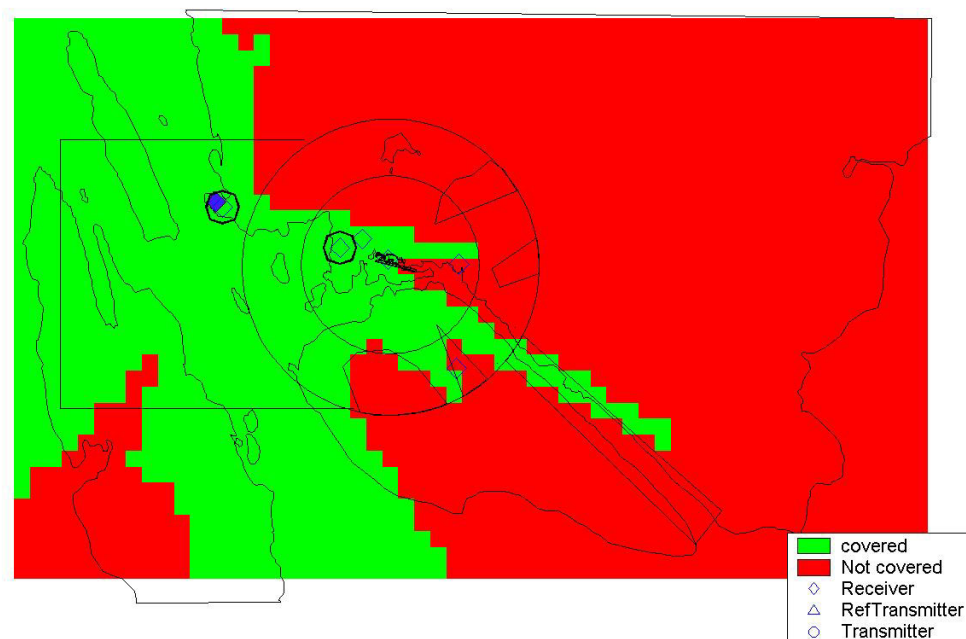


Figure 12 – AT&T Lena Point Tower

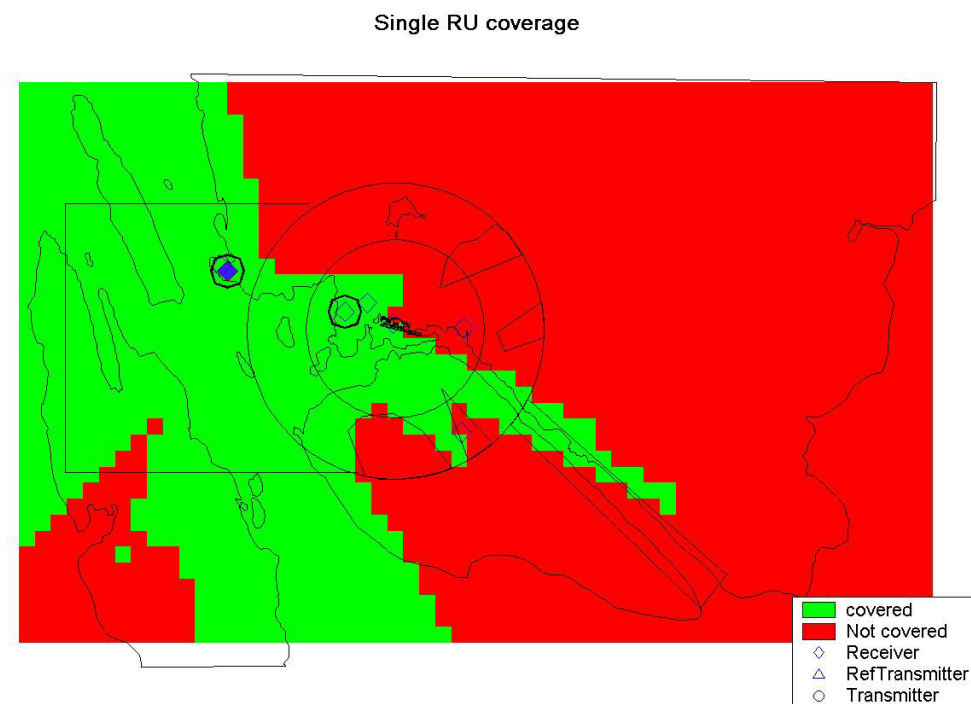


Figure 13 – Lena Point FAA RCAG Site

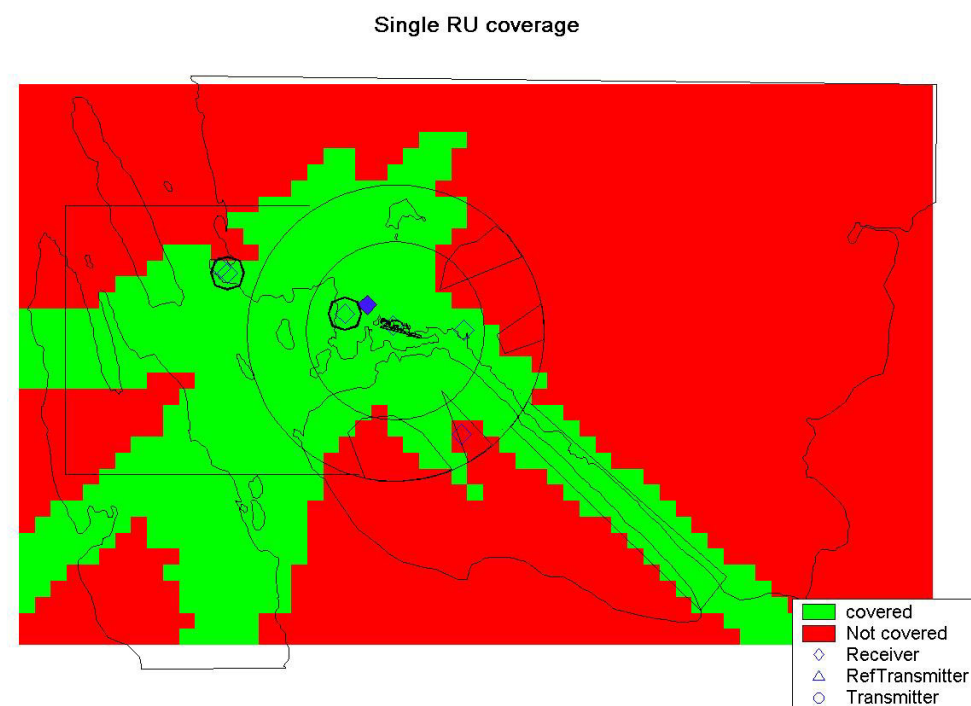


Figure 14 – AT&T Mile 11 Tower Site

Single RU coverage

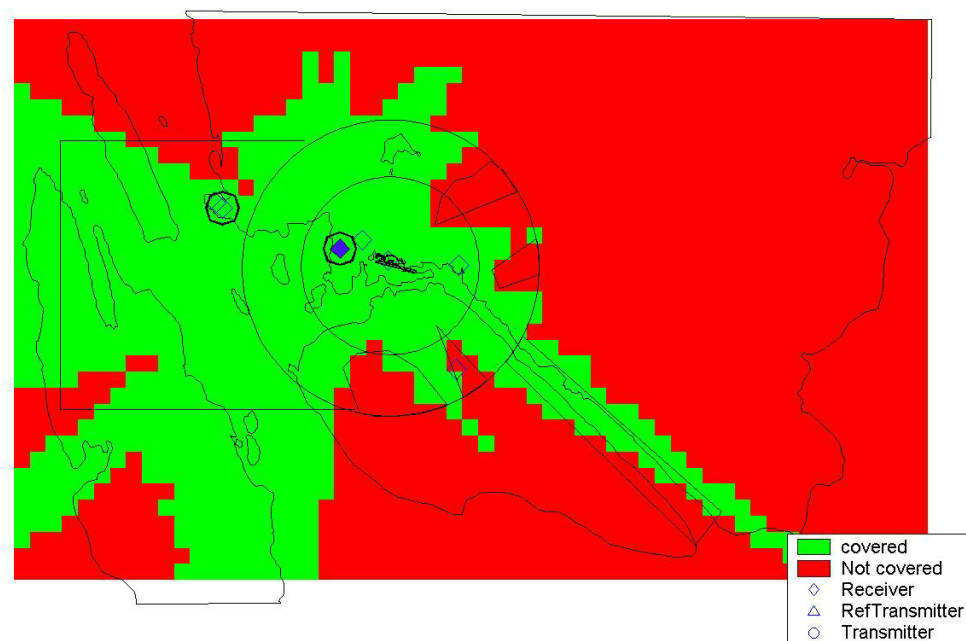


Figure 15 – Peterson Hill

Single RU coverage

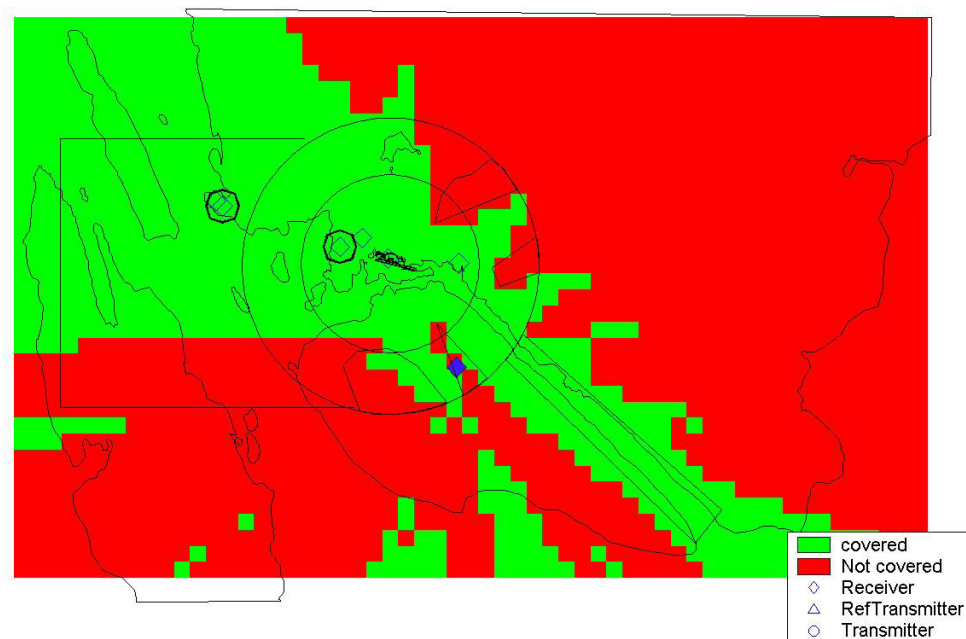
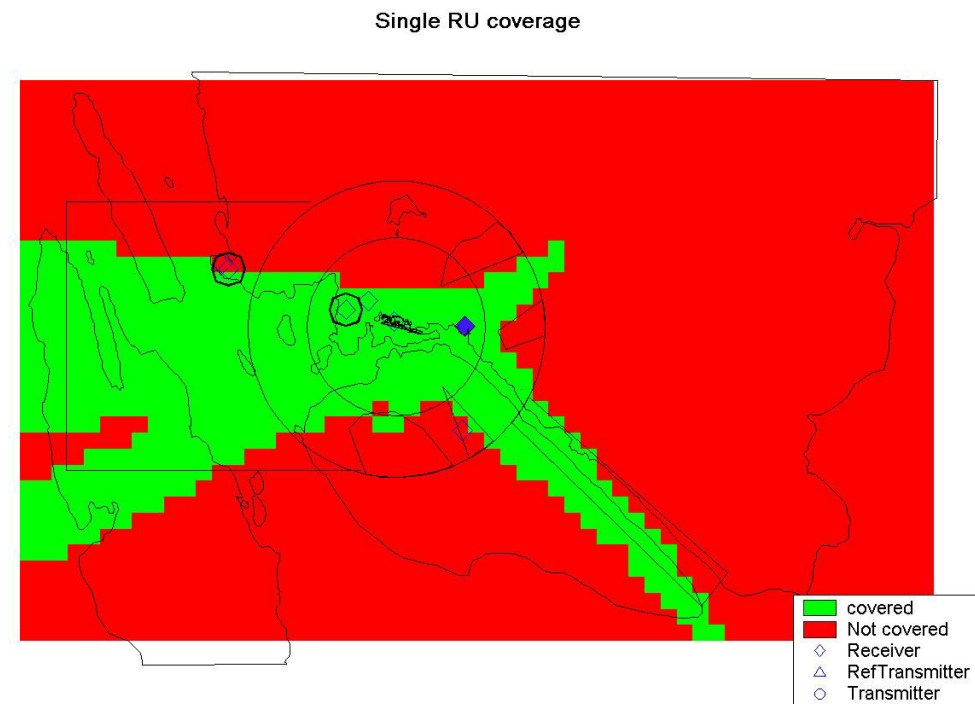


Figure 16 – Lemon Creek Police Station



**Figure 17 – Saddle Mountain Police Radio Site**

### 3. Critical RU Analysis

#### 3.2 500ft AGL

Table 2 contains a summary of precision and coverage of the movement area without the indicated RU at 500ft AGL. Figure 18 through Figure 24 depict the resulting coverage map in the situation where the indicated RU became non-functional.

Table 2 – RU Criticality 500ft AGL

RU Site	4 or more Receiver Percentage	Precision < 200ft w/o RU	Maximum value (ft)
1	54.5%	73.5%	1741.5
2	60.7%	75.2%	161.4
3	60.5%	74.5%	161.9
4	55.5%	76.5%	1741.5
5	47.2%	71.9%	1741.5
6	50.4%	71.9%	437.9
7	64.0%	78.3%	1741.5

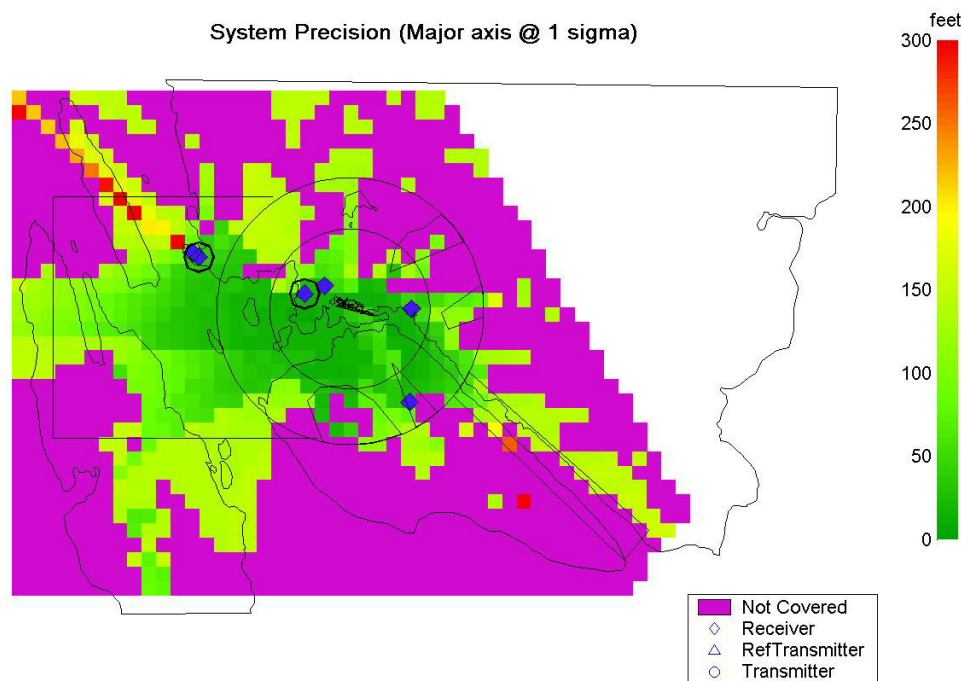


Figure 18 – ATCT RU drop out

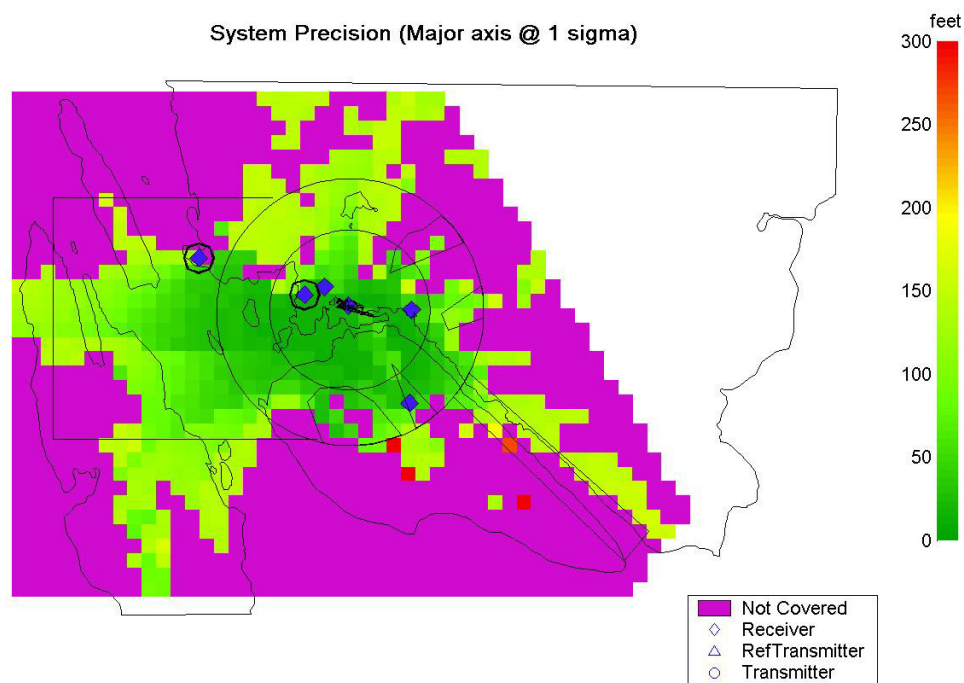


Figure 19 – AT&T Lena Point Tower RU drop out

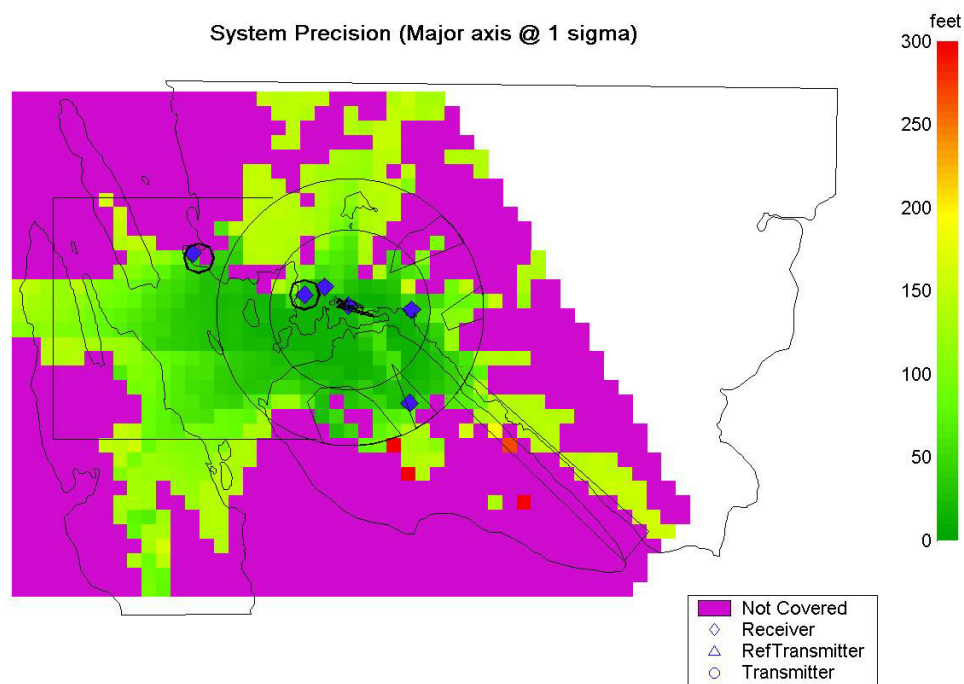


Figure 20 – Lena Point FAA RCAG Site RU drop out

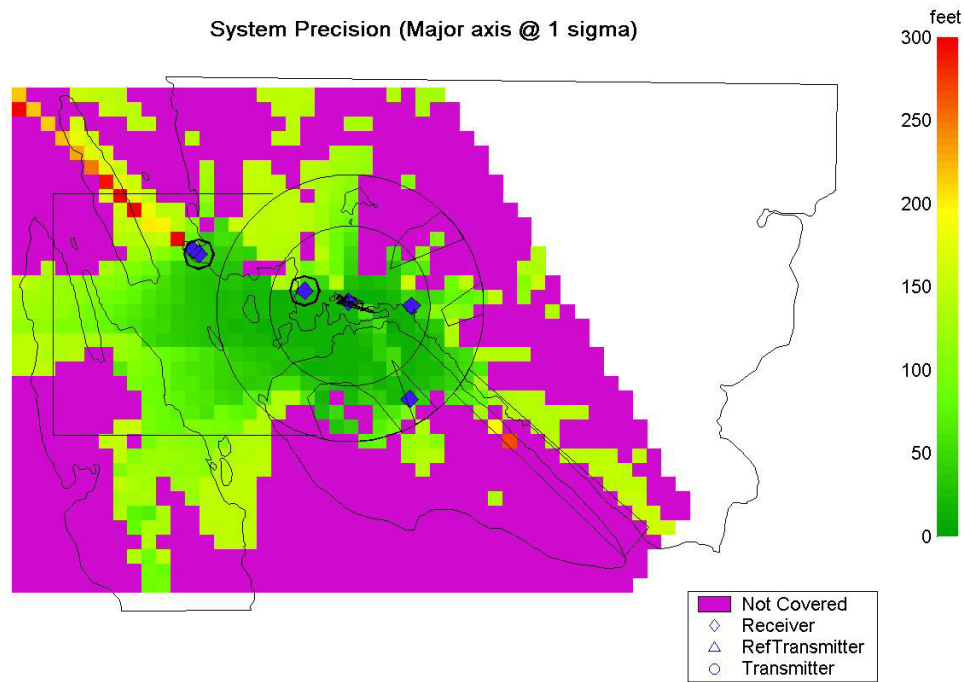


Figure 21 – AT&T Mile 11 Tower Site RU drop out

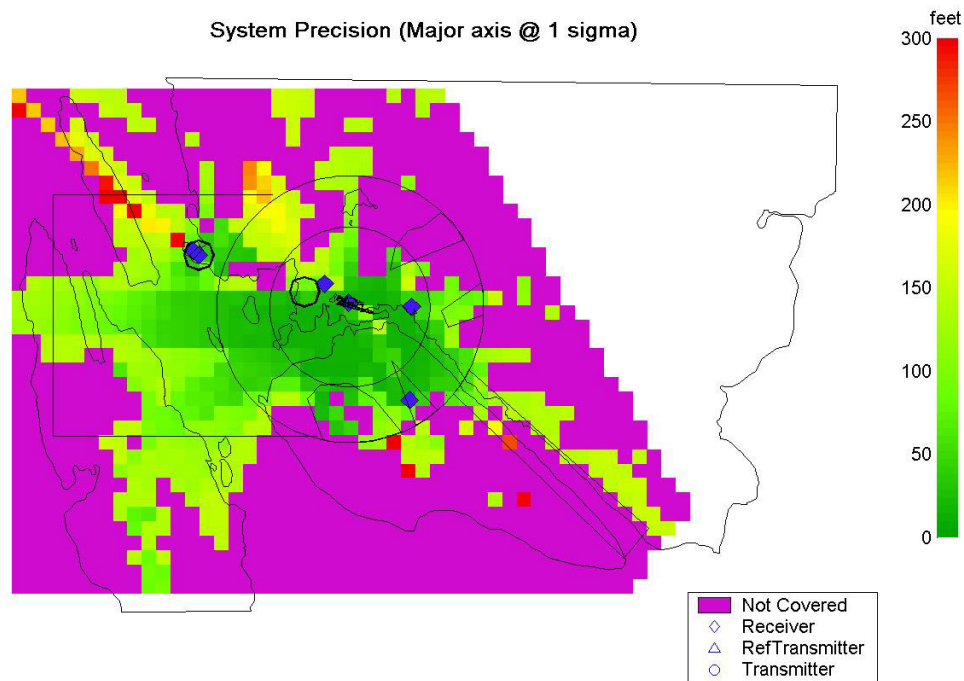


Figure 22 – Peterson Hill RU drop out

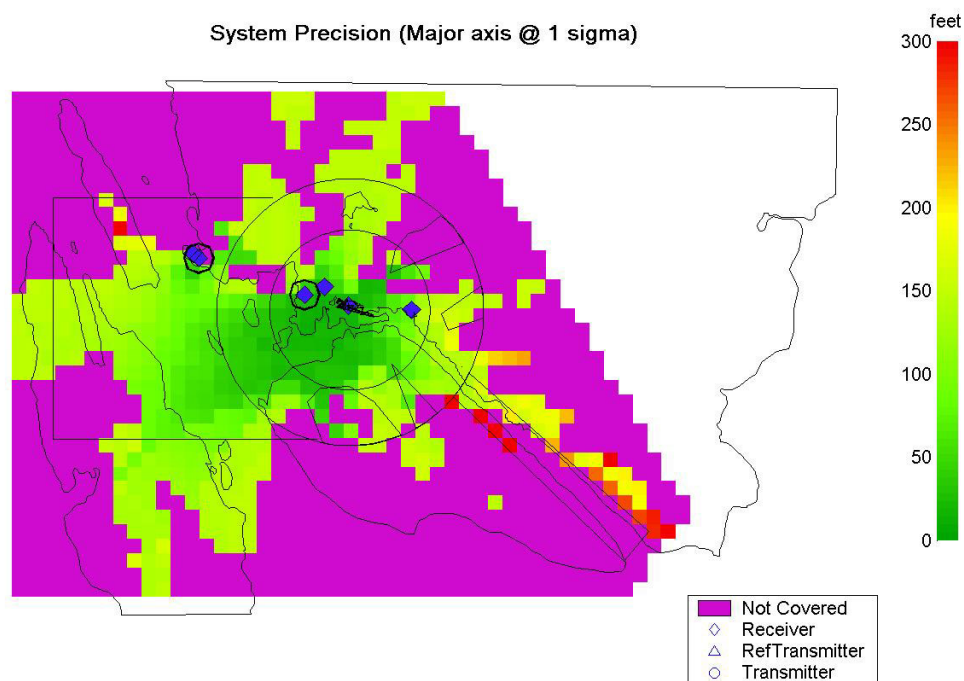


Figure 23 – Lemon Creek Police Station RU drop out

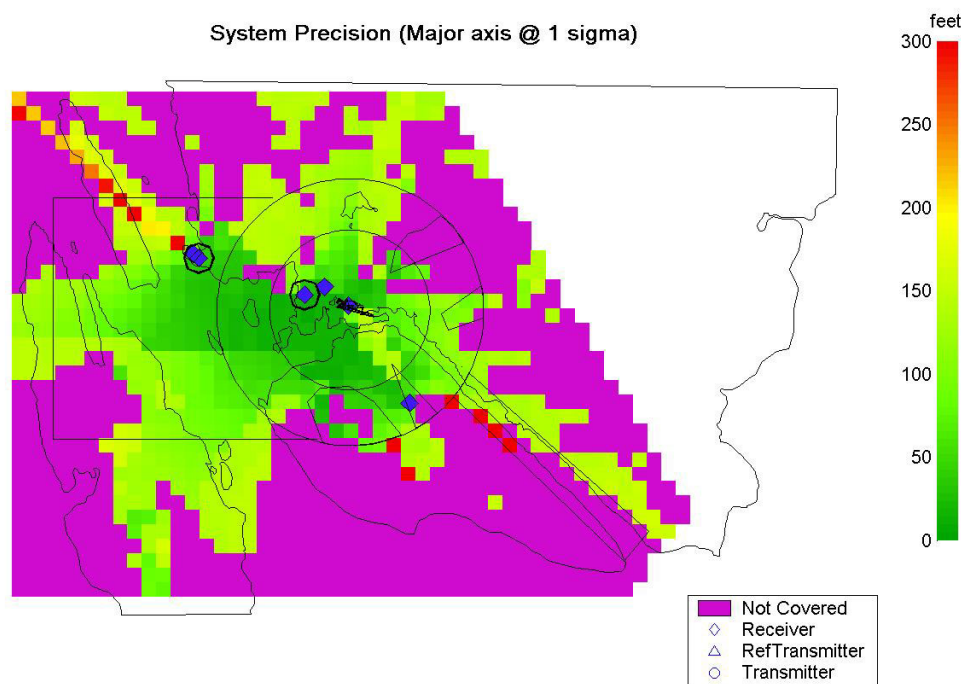


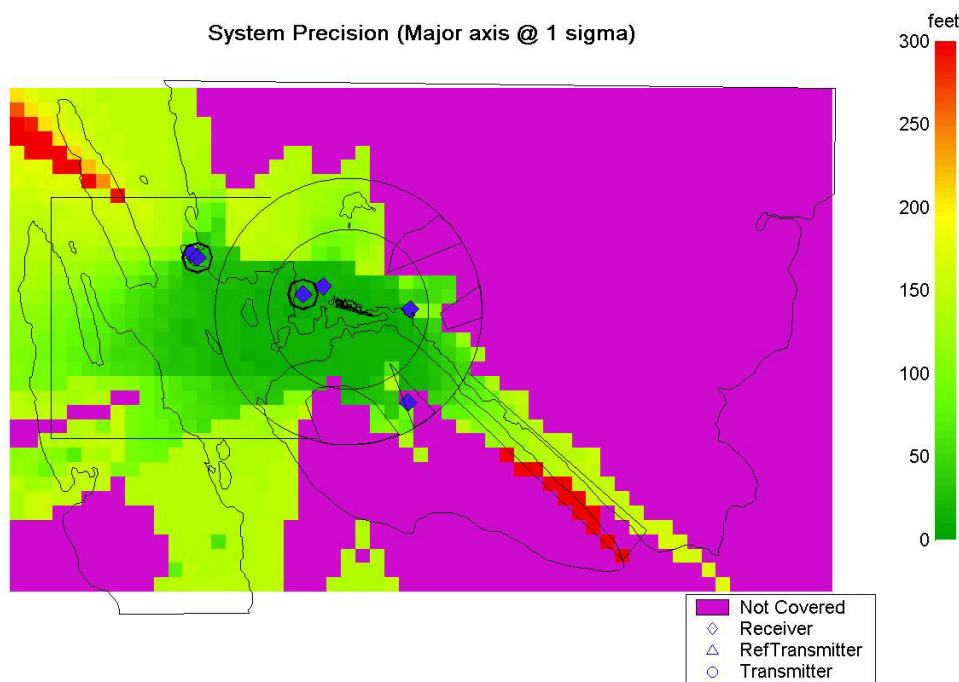
Figure 24 – Saddle Mountain Police Radio Site RU drop out

### 3.2 2000ft AMSL

Table 3 contains a summary of precision and coverage of the movement area without the indicated RU at 500ft AGL. Figure 25 through Figure 31 depict the resulting coverage map in the situation where the indicated RU became non-functional.

**Table 3 – RU Criticality 2000ft AMSL**

RU Site	4 or more Receiver Percentage	Precision < 200ft w/o RU	Maximum Precision (ft)
1	74.0%	92.2%	174.4
2	86.3%	90.9%	161.9
3	86.3%	90.9%	399.1
4	74.9%	92.7%	399.1
5	72.5%	90.8%	1969.8
6	74.1%	89.3%	1200.6
7	87.0%	92.7%	709.7



**Figure 25 – ATCT RU drop out**

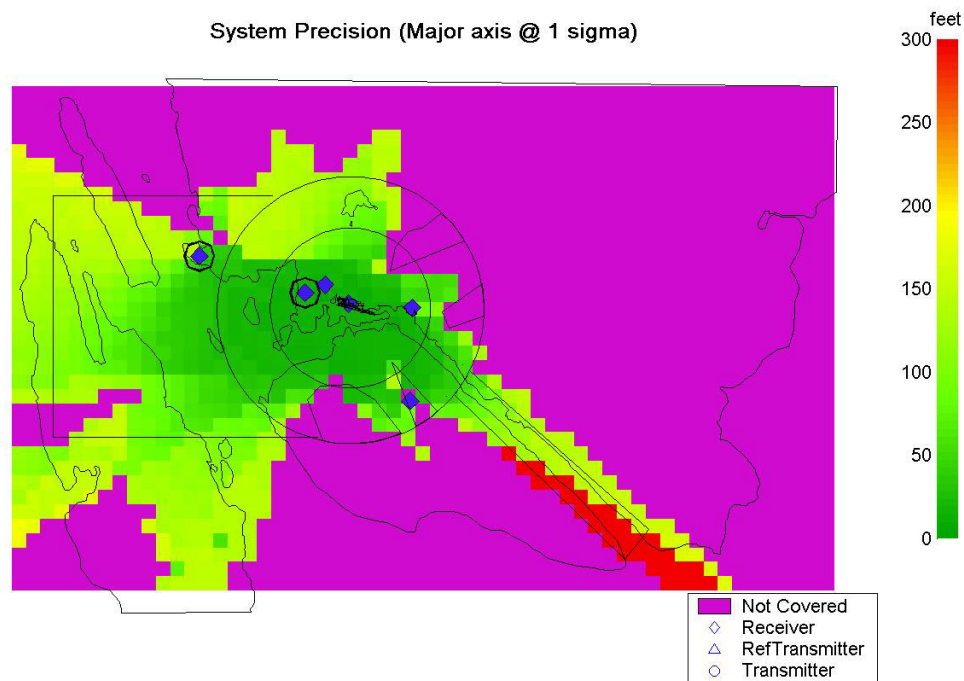


Figure 26 – AT&T Lena Point Tower RU drop out

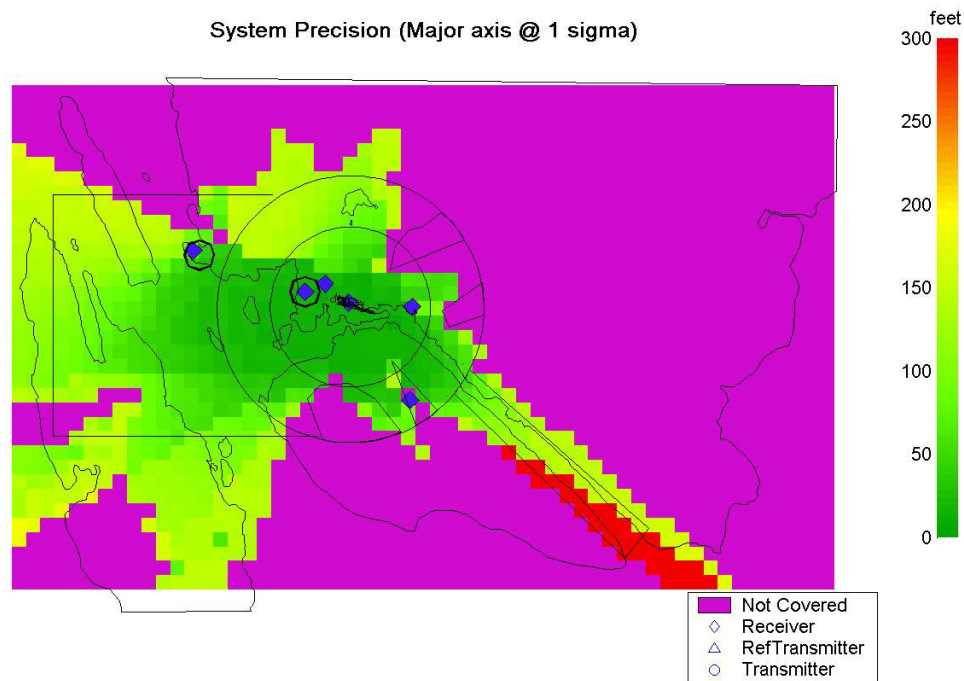


Figure 27 – Lena Point FAA RCAG Site RU drop out

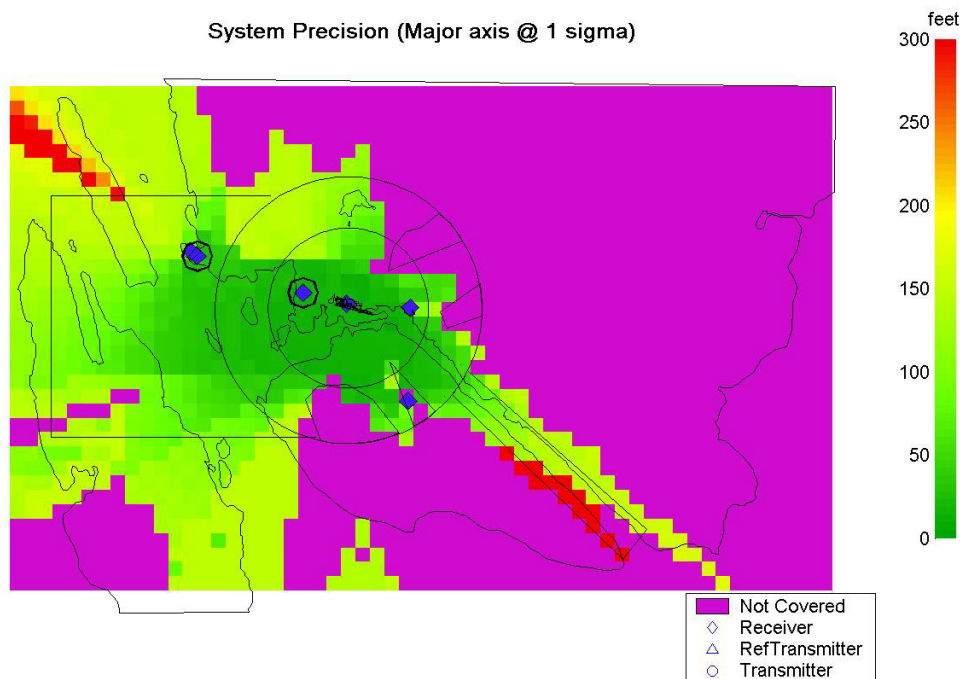


Figure 28 – AT&T Mile 11 Tower Site RU drop out

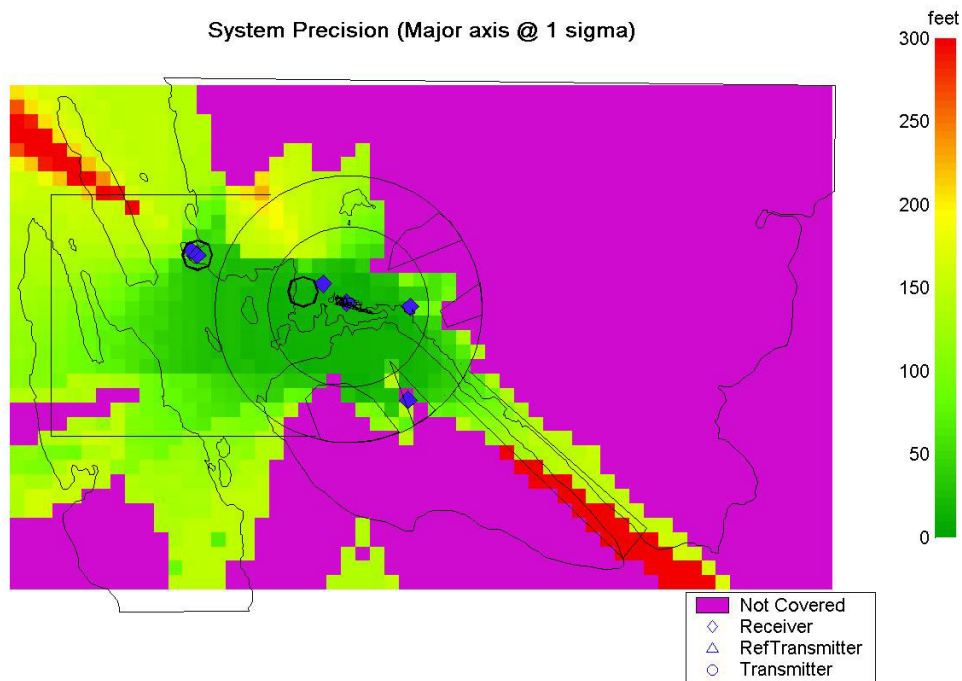


Figure 29 – Peterson Hill RU drop out

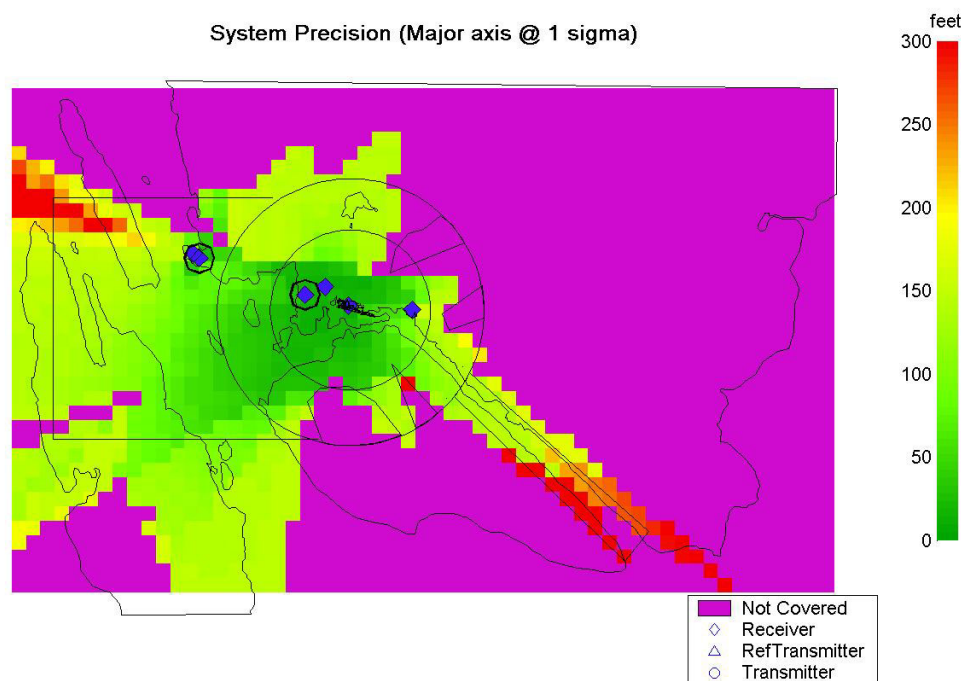


Figure 30 – Lemon Creek Police Station RU drop out

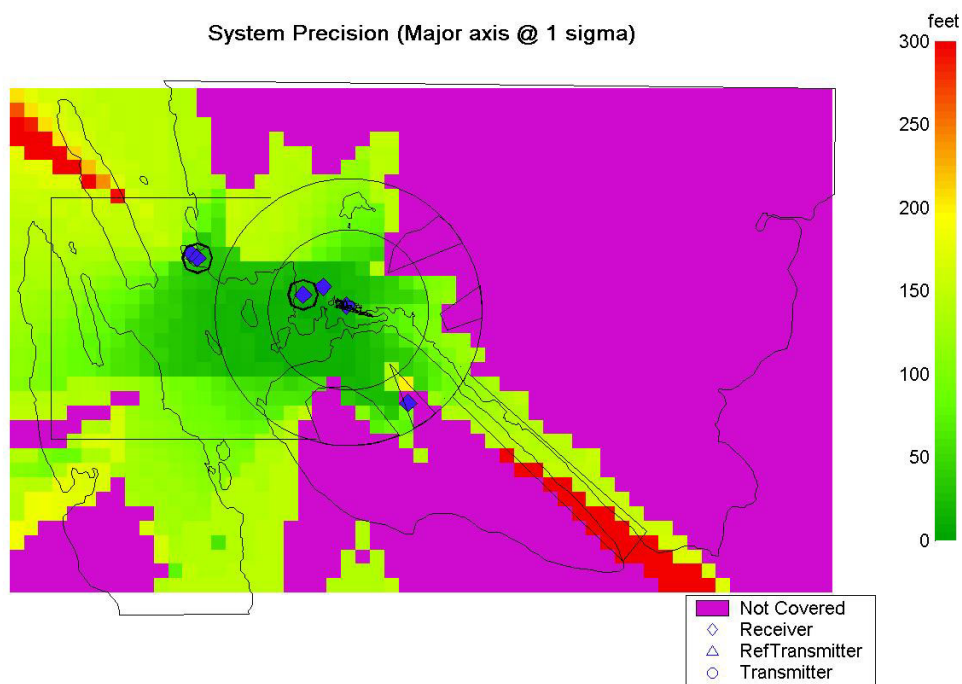


Figure 31 – Saddle Mountain Police Radio Site RU drop out

**Appendix C:**  
**“ASDE-X Remote Unit Communication Requirements”**

The FAA levies the following requirements on telecommunications service providers for surveillance data. The ASDE-X system requires 64Kbps digital connectivity, which can be obtained through a Digital Data Service over a DS0 line. The DS0 can be configured with or without a secondary channel that is used by some CSU/DSU pairs for checking the health of the link.

The FAA can order this service through their current LINCOS and future FTI telecommunications service contracts. The service is defined in the FAA Telecommunications Service Description (FTSD) document. Commercial CSU/DSU pairs meet the ANSI T1.410 requirements, therefore those units will work with this link type.

### **Digital Data Service (DDS)**

The DDS service shall conform to the following standards and requirements:

- a. The DDS interface shall be required to provide digital data transmissions between defined Service Delivery Points.
- b. The DDS interface shall support data transfer rates of 56Kbps and 64 kbps.
- c. The DDS interface shall meet the following interface requirements:
  1. DDS interface shall conform to the requirements of ANSI T1.410-1992 except as otherwise specified herein.
  2. DDS interface shall meet the formatting requirements of ANSI T1.410-1992.
  3. Synchronization between the DDS Service Type circuits and user equipment shall be in accordance with the requirements of Bellcore TA-NWT-000436.
  4. DDS interface shall provide line coding in accordance with ANSI T1.410-1992.
  5. DDS interface shall support DS-0B formatting in accordance with Bellcore GR-499-CORE Section 10.1.2
  6. DDS interface shall support DS-0A formatting in accordance with Bellcore GR-499-CORE Section 10.1.2.
  7. DDS interface shall provide the secondary channel, in accordance with ANSI T1.410-1992.
  8. DDS interface shall support latching and non-latching loopbacks (remote and local)

The end-to-end DDS service shall meet the following performance requirements:

- a. The DDS connectivity shall be considered unavailable when a consecutive severely errored second (CSES) event occurs, ie., after ten severely errored seconds (SES) have occurred consecutively.
- b. An errored second (ES) for the DDS service shall be a second in which one or more bit errors are received.
- c. A SES shall be any second in which the Bit Error Rate (BER) is worse than one times ten to the minus five ( $1 \times 10^{-5}$ ).
- d. The DDS connectivity shall provide a minimum of 99.9 percent error free seconds for any 24-hour period.

- e. The connectivity shall be considered unavailable and restoration processes shall commence when:
  1. the number of errored seconds exceeds eighty-six (86) in any period of twenty-four (24) hours or less, or
  2. the number of errored seconds equals or exceeds five (5) in any period of fifteen (15) minutes or less, or
  3. the percentage of error free seconds does not return to a minimum of 99.9 percent over a two hour period of observation after a restoration.
- f. The unavailable connectivity shall be designated as available when:
  1. restoration activities have been completed and
  2. ten consecutive seconds of data have been processed and
  3. no errored seconds have occurred.

### Configuration

**Table 1 provides the minimum configurations, in descending order of preference, which must be supported for each DDS ordered for ASDE-X.**

- a. The DS0-A mapping shall be as specified in section 10.1.2.1 of Bellcore GR-499-CORE.
- b. The DS0-B mapping shall be as specified in section 10.1.2.2 of GR-499-CORE.
- c.

If error correction is needed for the circuit, then the mappings in section 10.1.2.3 of GR-499-CORE shall be used for either DS0-B or DS0-A formatting.

**Table 1 Configurations for DDS Services**

Interface Number	Type	Data Rate	Formatting
DDS17	DDS-64	64 Kbps	DS0-A with Secondary channel
DDS18	DDS-64	64 Kbps	DS0-A without Secondary channel
DDS16	DDS-64	64 Kbps	DS0-B

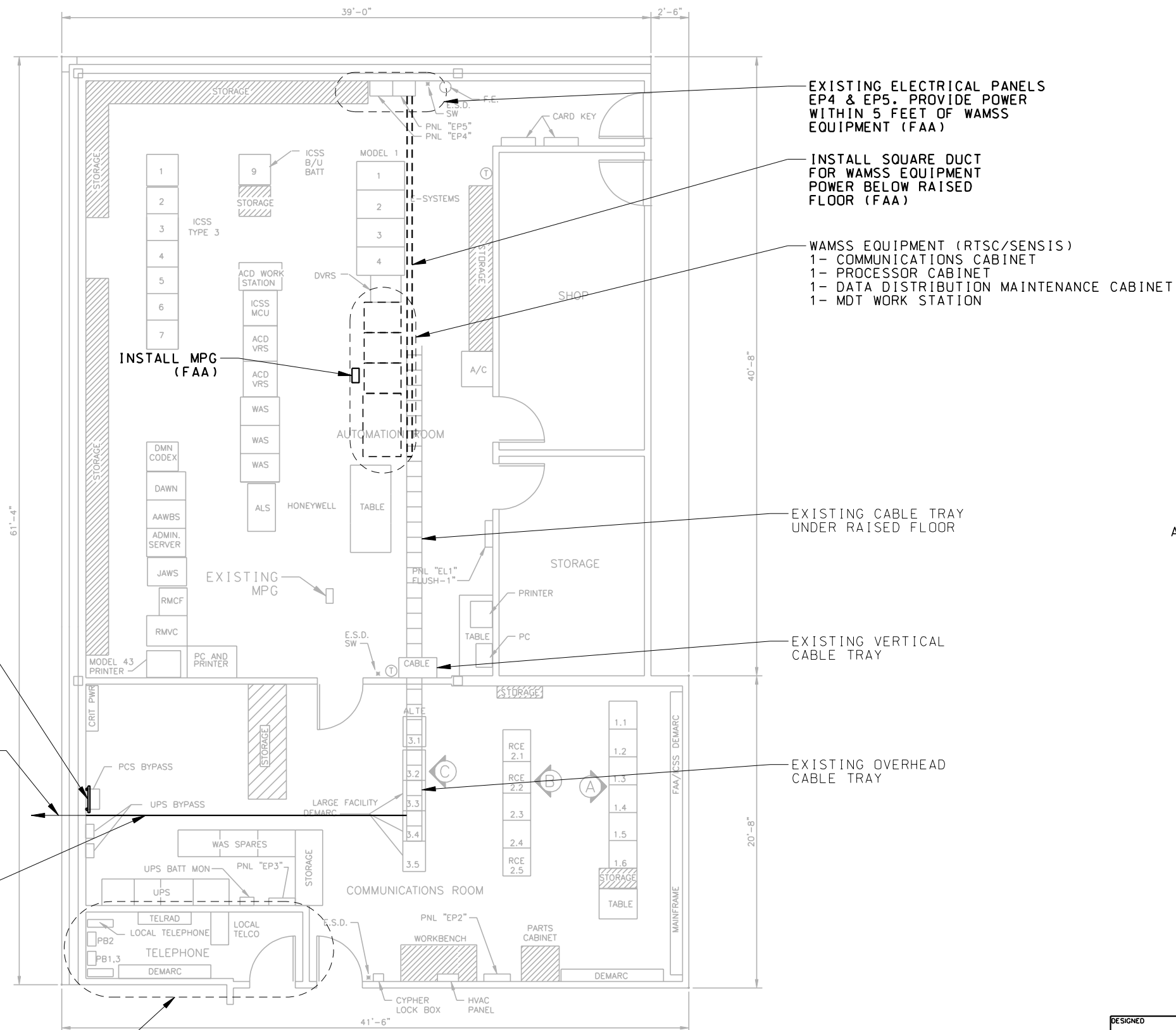
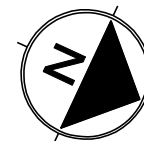
DS-0A with secondary channel- Mostly widely used DDS circuit type (DDSII). Telco providers generally use this format for circuits. This line provides a 72 kb/s data rate whether it's 56k or 64k circuit. Signaling bits are run over secondary channel providing no overhead on data transmissions. These circuits generally have cost savings associated with them due to their use being favored by Telco providers.

DS-0A without secondary channel - Single channel DDS. Signaling bits are included in the data stream, incurring overhead on the transmission of user data.

DS-0B - Used for subrate DDS (i.e. 9.6 kb/s, 19.2 kb/s etc.) A DS0 is multiplexed with other sub-rate inputs towards the network.

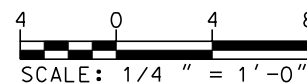
**Appendix D:**  
**WAM System Site Preparation Requirement Drawings**





AFSS COMM/AUTOMATION ROOMS - WAMSS EQUIPMENT LAYOUT

SCALE: 1/4" = 1'-0"



SCALE: 1/4" = 1'-0"

EXISTING ELECTRICAL PANELS  
EP4 & EP5. PROVIDE POWER  
WITHIN 5 FEET OF WAMSS  
EQUIPMENT (FAA)

INSTALL SQUARE DUCT  
FOR WAMSS EQUIPMENT  
POWER BELOW RAISED  
FLOOR (FAA)

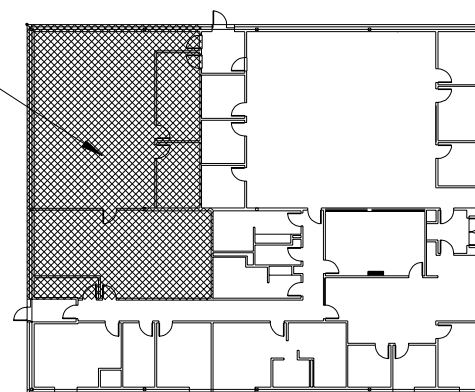
WAMSS EQUIPMENT (RTSC/SENSIS)  
1- COMMUNICATIONS CABINET  
1- PROCESSOR CABINET  
1- DATA DISTRIBUTION MAINTENANCE CABINET  
1- MDT WORK STATION

EXISTING CABLE TRAY  
UNDER RAISED FLOOR

EXISTING VERTICAL  
CABLE TRAY

EXISTING OVERHEAD  
CABLE TRAY

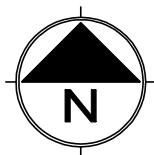
AREA SHOWN

KEY PLAN  
N.T.S.**- NOT FOR CONSTRUCTION -****NOTES**

1. REFERENCE FAA DRAWING ALD-JNU-471.103CM,  
REV 4.

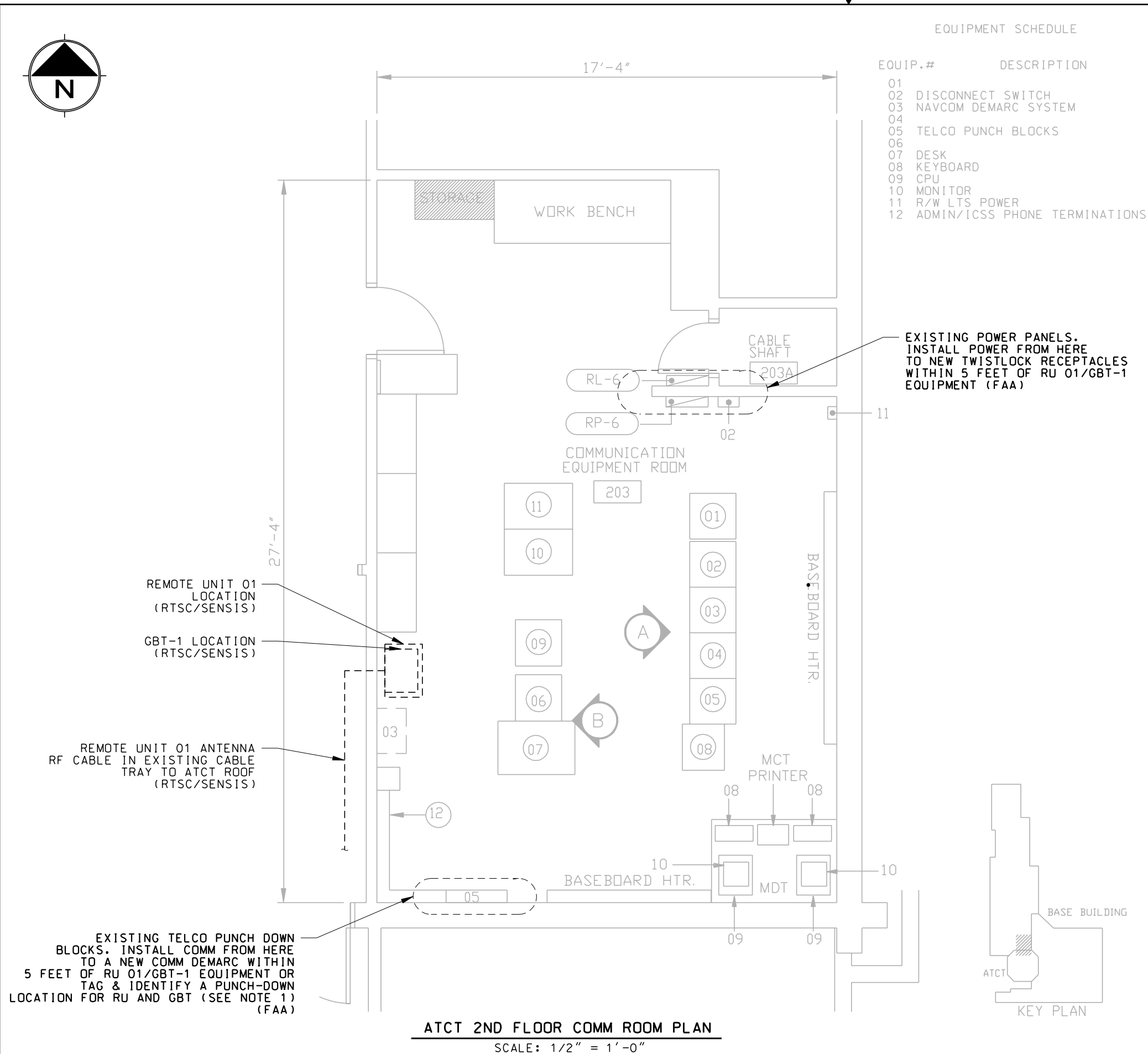
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-	2004/06/25	DRAFT SUBMISSION

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DRAWN	sls	BURLINGTON MA, 01803		
CHECKED	RNF	WIDE AREA MULTI-LATERATION SURVEILLANCE SYSTEM (WAMSS) - FEDERAL AVIATION ADMINISTRATION, ALASKA REGION, FAIRBANKS, AK AFSS COMM/AUTOMATION ROOMS, JUNEAU, AK WAMSS EQUIPMENT LAYOUT		
SCALE NOTE: THIS DRAWING MAY HAVE BEEN PLOTTED AT A REDUCED OR LARGER SIZE. USE SCALES WITH CAUTION.		CAD FILE	DATE (YYYY/MM/DD)	DRAWING NO
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		REV.		-



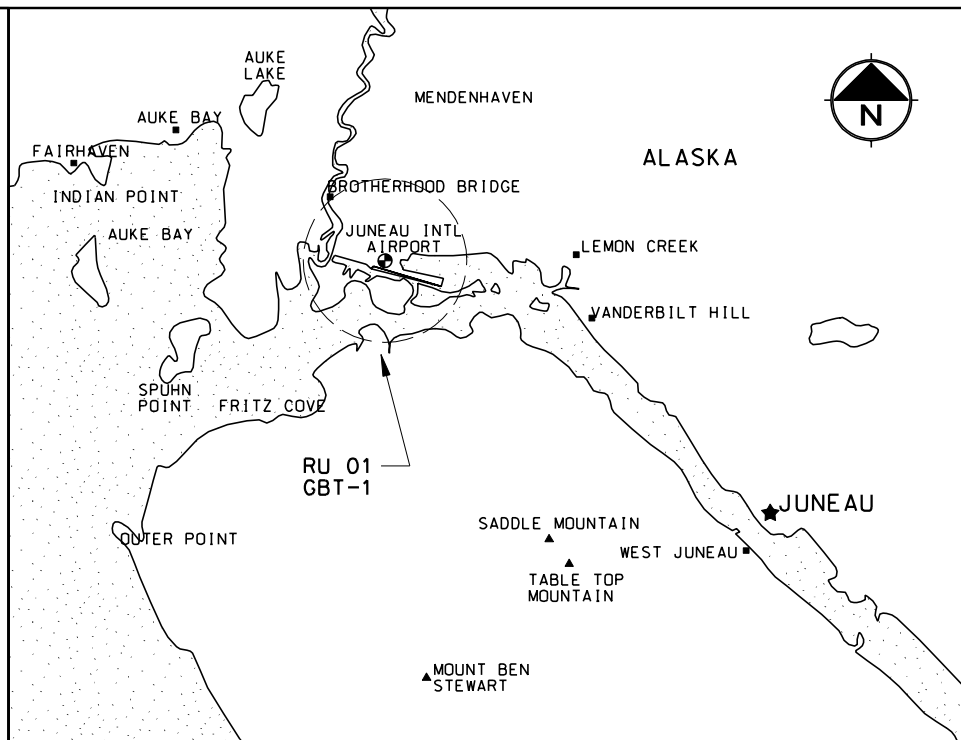
B

A



B

A



REMOTE UNIT 01 & GBT-1 LOCUS PLAN  
NOT TO SCALE

- NOT FOR CONSTRUCTION -

NOTES

- ONE COMM. LINE TO BE INSTALLED FOR REMOTE UNIT AND ONE COMM. LINE INSTALLED FOR GBT.
- REFERENCE FAA DRAWING ALD-JNU-522.006CM, REV 4.

REV.	DATE	DESCRIPTION
N/A	N/A	FINAL SUBMISSION
-	2004/06/25	DRAFT SUBMISSION

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DRAWN	sis	BURLINGTON MA, 01803		
CHECKED	RNF	WIDE AREA MULTI-LATERATION SURVEILLANCE SYSTEM (WAMSS) - FEDERAL AVIATION ADMINISTRATION, ALASKA REGION, FAIRBANKS, AK JUNEAU INTERNATIONAL AIRPORT, JUNEAU, ALASKA REMOTE UNIT 01 AND GBT-1 AT ATCT		
SCALE: NOTE: THIS DRAWING MAY HAVE BEEN PLOTTED AT A REDUCED OR LARGER SIZE. USE SCALES WITH CAUTION.		CAD FILE	DATE (YYYY/MM/DD)	DRAWING NO
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				REV.
				-

4

3

2

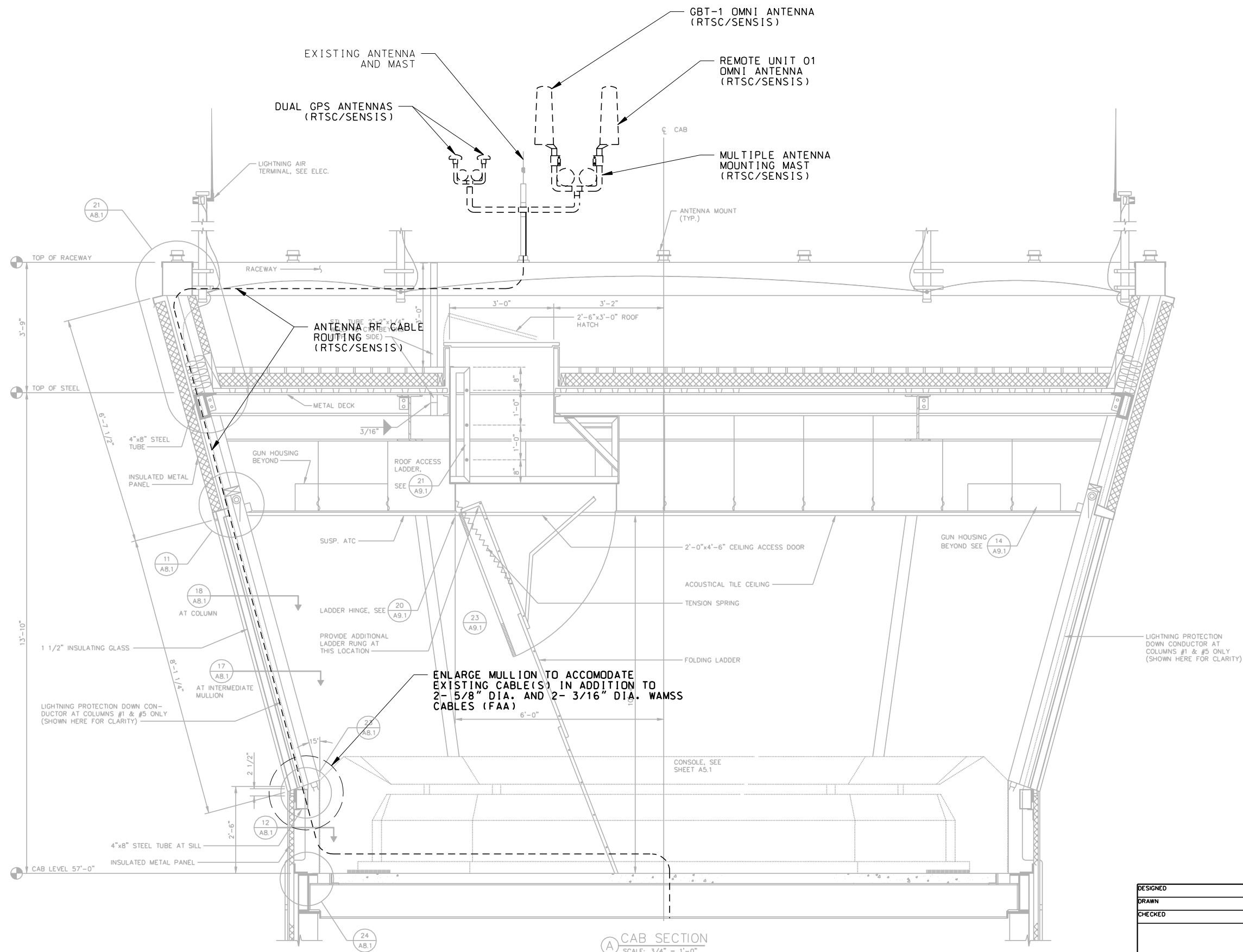
1

B

B

A

A



**ATCT CAB SECTION**  
**REMOTE UNIT 01 & GBT-1 ANTENNA MOUNTING**  
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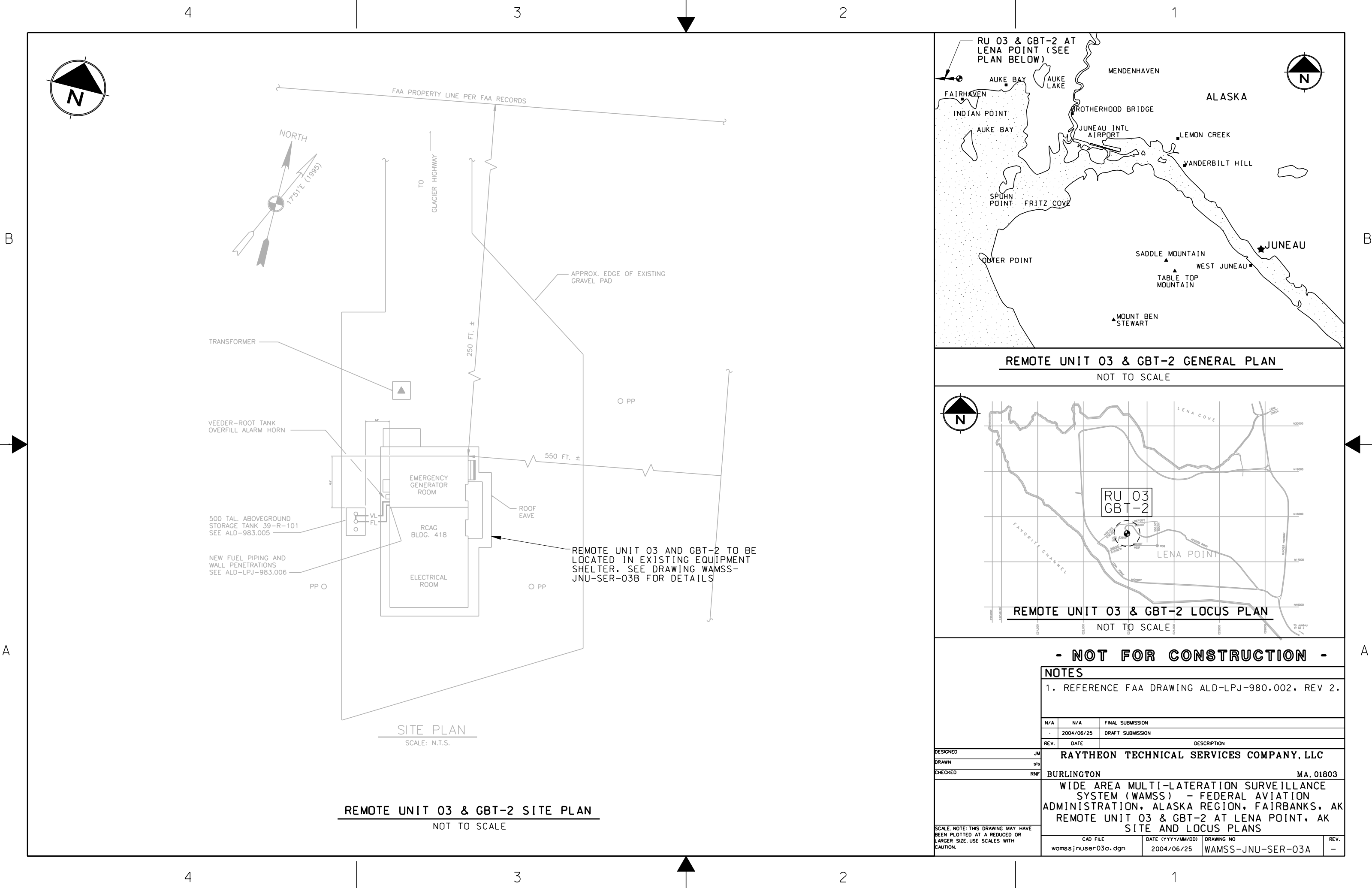
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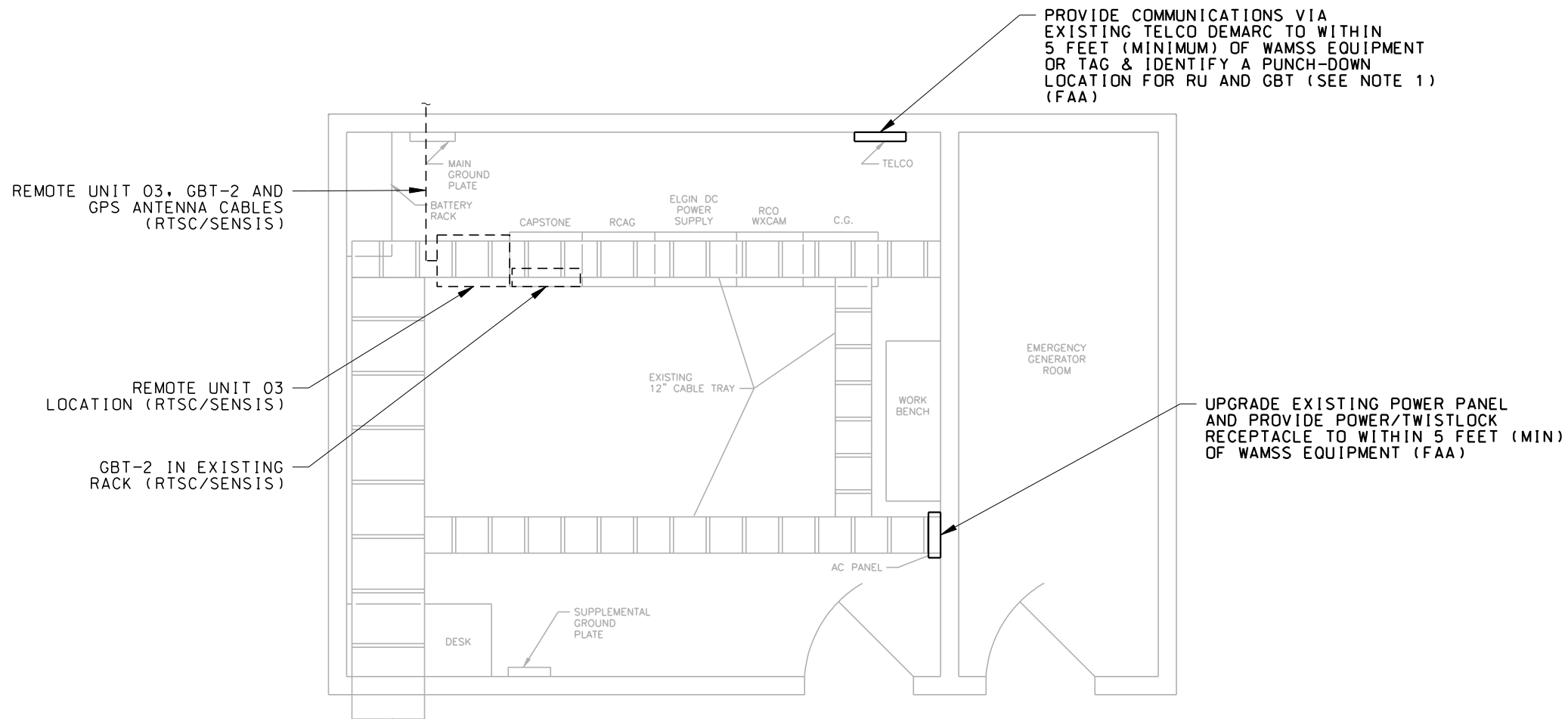
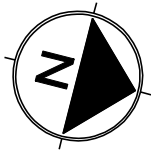
**NOTES**

1. REFERENCE FAA DRAWING ALD-JNU-522.108, REV 1.

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DRAWN	sls			
CHECKED	RNF	BURLINGTON MA, 01803		
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SCALE: NOTE: THIS DRAWING MAY HAVE BEEN PLOTTED AT A REDUCED OR LARGER SIZE. USE SCALES WITH CAUTION.		CAD FILE	DATE (YYYY/MM/DD)	DRAWING NO
		wamssjnuser01b.dgn	2004/06/25	WAMSS-JNU-SER-01B
				REV.
				-





RCAG FLOOR PLAN  
SCALE: 1/2"=1'-0"

REMOTE UNIT 03 & GBT-2 PLAN IN EXISTING SHELTER  
NOT TO SCALE

- NOT FOR CONSTRUCTION -

NOTES			
1. ONE COMM. LINE TO BE INSTALLED FOR REMOTE UNIT AND ONE COMM. LINE INSTALLED FOR GBT.			
2. REFERENCE FAA DRAWING ALD-LPJ-751.001, REV 3.			
N/A	N/A	FINAL SUBMISSION	
-	2004/06/25	DRAFT SUBMISSION	
REV.	DATE	DESCRIPTION	
RAYTHEON TECHNICAL SERVICES COMPANY, LLC			
BURLINGTON		MA, 01803	
WIDE AREA MULTI-LATERATION SURVEILLANCE SYSTEM (WAMSS) - FEDERAL AVIATION ADMINISTRATION, ALASKA REGION, FAIRBANKS, AK REMOTE UNIT 03 & GBT-2 AT LENA POINT, AK FLOOR PLAN			
CAD FILE		DATE (YYYY/MM/DD)	DRAWING NO
wamssjnuser03b.dgn		2004/06/25	WAMSS-JNU-SER-03B
			REV.
			-

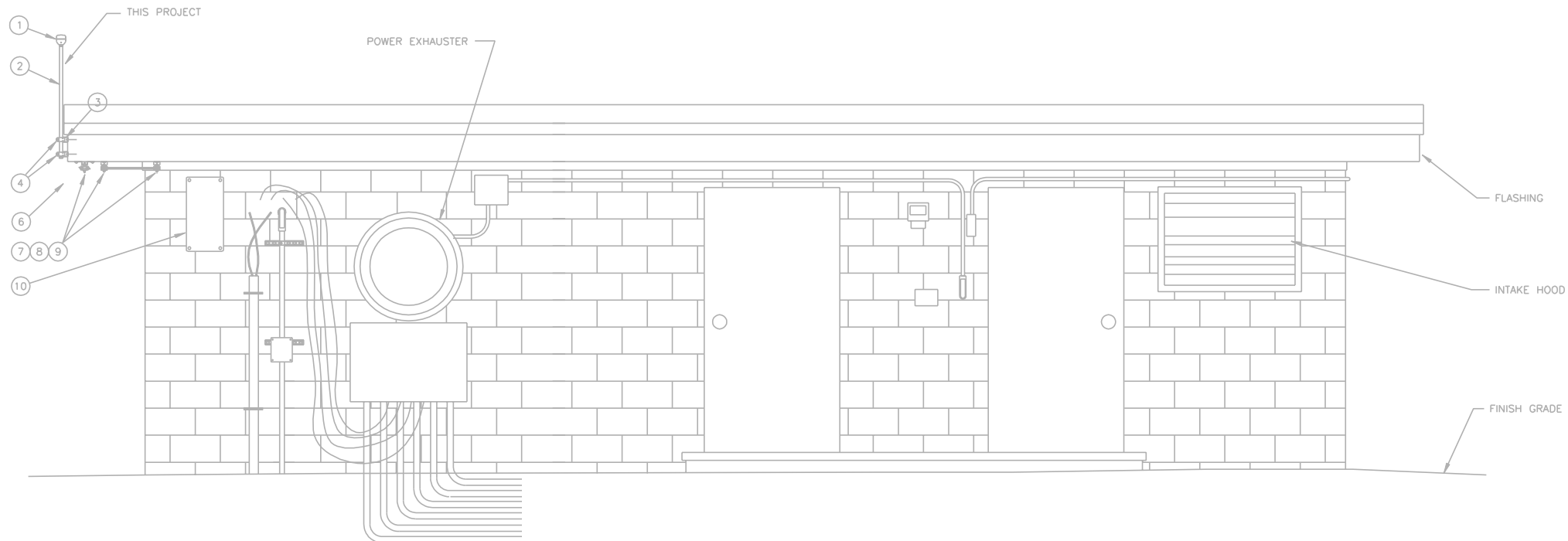
DESIGNED	JM
DRAWN	sls
CHECKED	RNF
SCALE NOTE: THIS DRAWING MAY HAVE BEEN PLOTTED AT A REDUCED OR LARGER SIZE. USE SCALES WITH CAUTION.	

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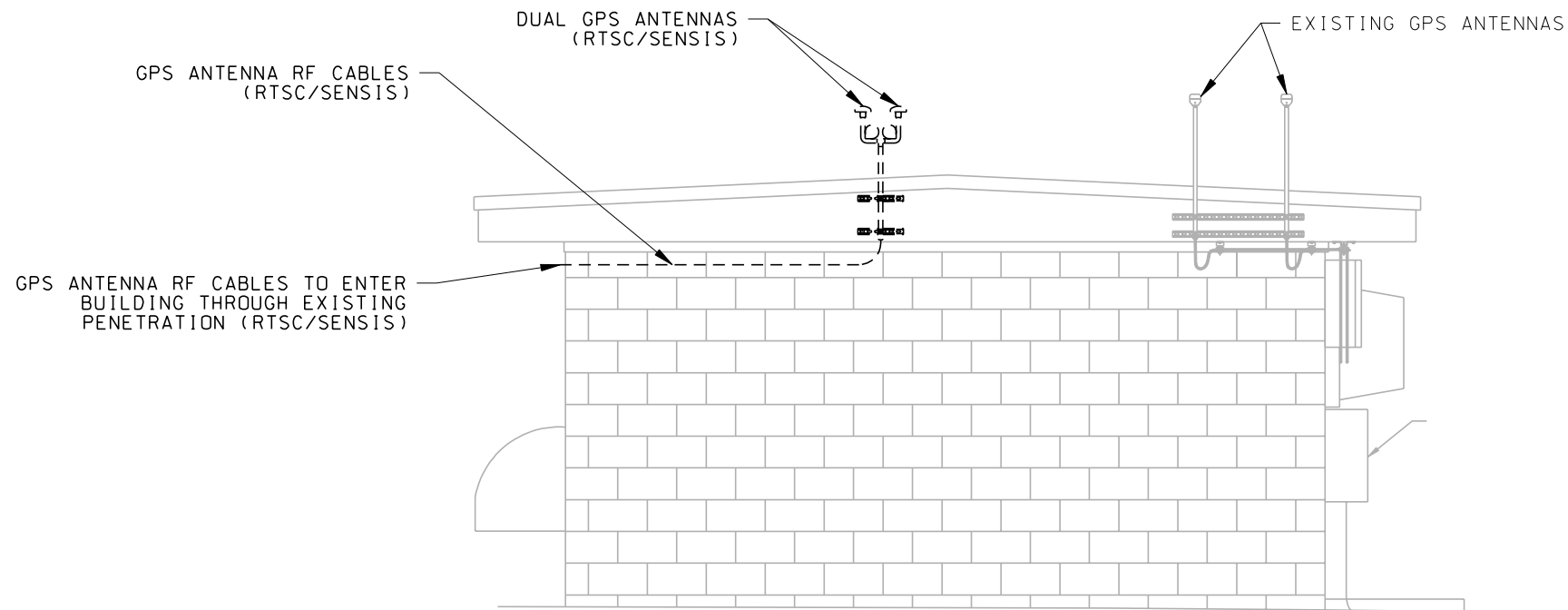
3

2

1



FRONT ELEVATION FACILITY BLDG.  
SCALE: N.T.S.



LEFT SIDE ELEVATION FACILITY BLDG.  
SCALE: N.T.S.  
(EXISTING CABLES NOT SHOWN FOR CLARITY)

**GBT-2 ANTENNA MOUNTING IN EXISTING SHELTER - SOUTH ELEVATION**  
NOT TO SCALE

**- NOT FOR CONSTRUCTION -**

**NOTES**

1. REFERENCE FAA DRAWING ALD-LPJ-S01, REV 1.

REV.	DATE	DESCRIPTION
N/A	N/A	FINAL SUBMISSION
-	2004/06/25	DRAFT SUBMISSION

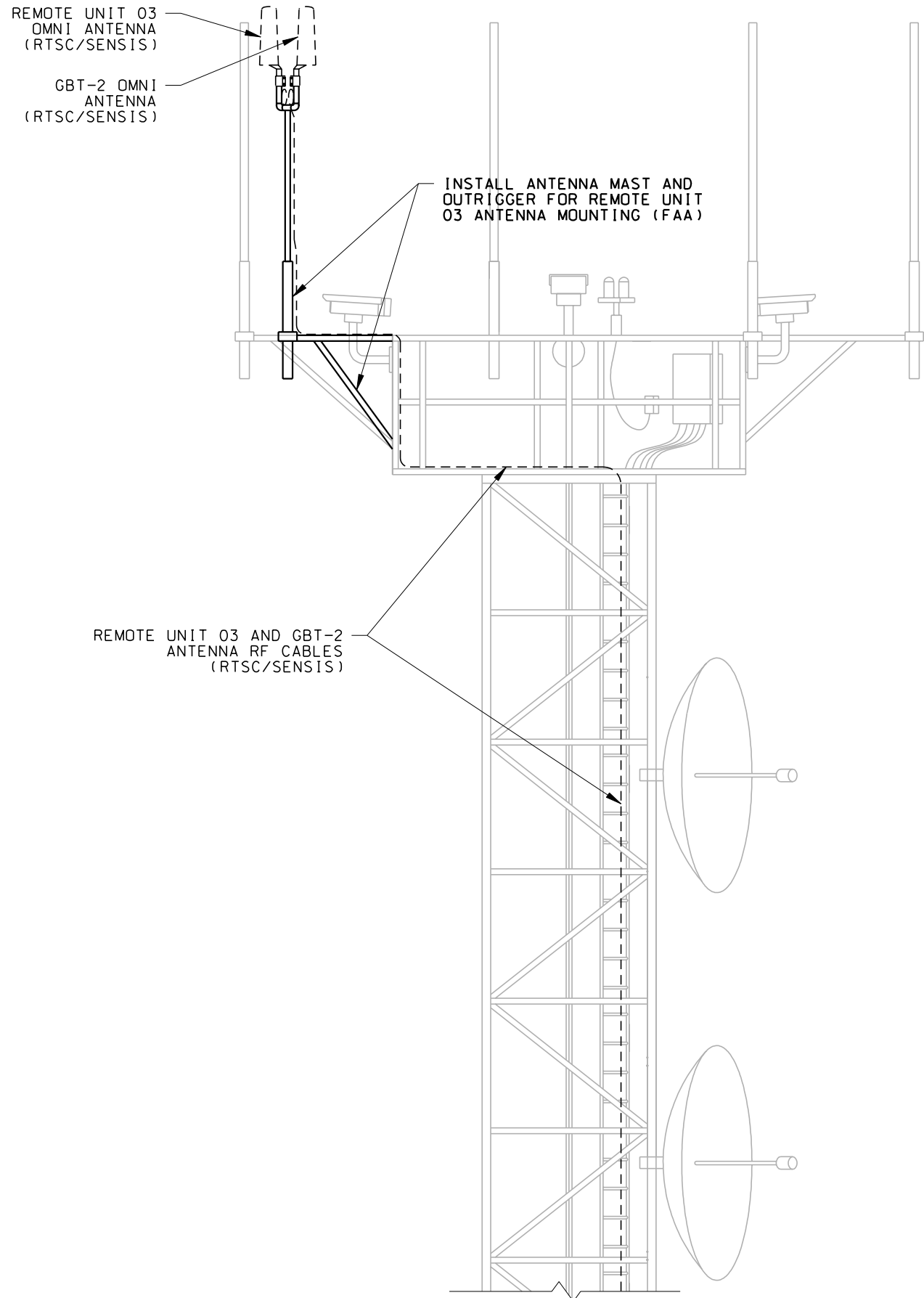
DESIGNED		RAYTHEON TECHNICAL SERVICES COMPANY, LLC			
DRAWN		BURLINGTON MA, 01803			
CHECKED		WIDE AREA MULTI-LATERATION SURVEILLANCE SYSTEM (WAMSS) - FEDERAL AVIATION ADMINISTRATION, ALASKA REGION, FAIRBANKS, AK REMOTE UNIT 03 & GBT-2 AT LENA POINT, AK GBT-2 ANTENNA MOUNTING			
SCALE NOTE: THIS DRAWING MAY HAVE BEEN PLOTTED AT A REDUCED OR LARGER SIZE. USE SCALES WITH CAUTION.		CAD FILE	DATE (YYYY/MM/DD)	DRAWING NO	REV.
		wamssjnuser03c.dgn	2004/06/25	WAMSS-JNU-SER-03C	-

4

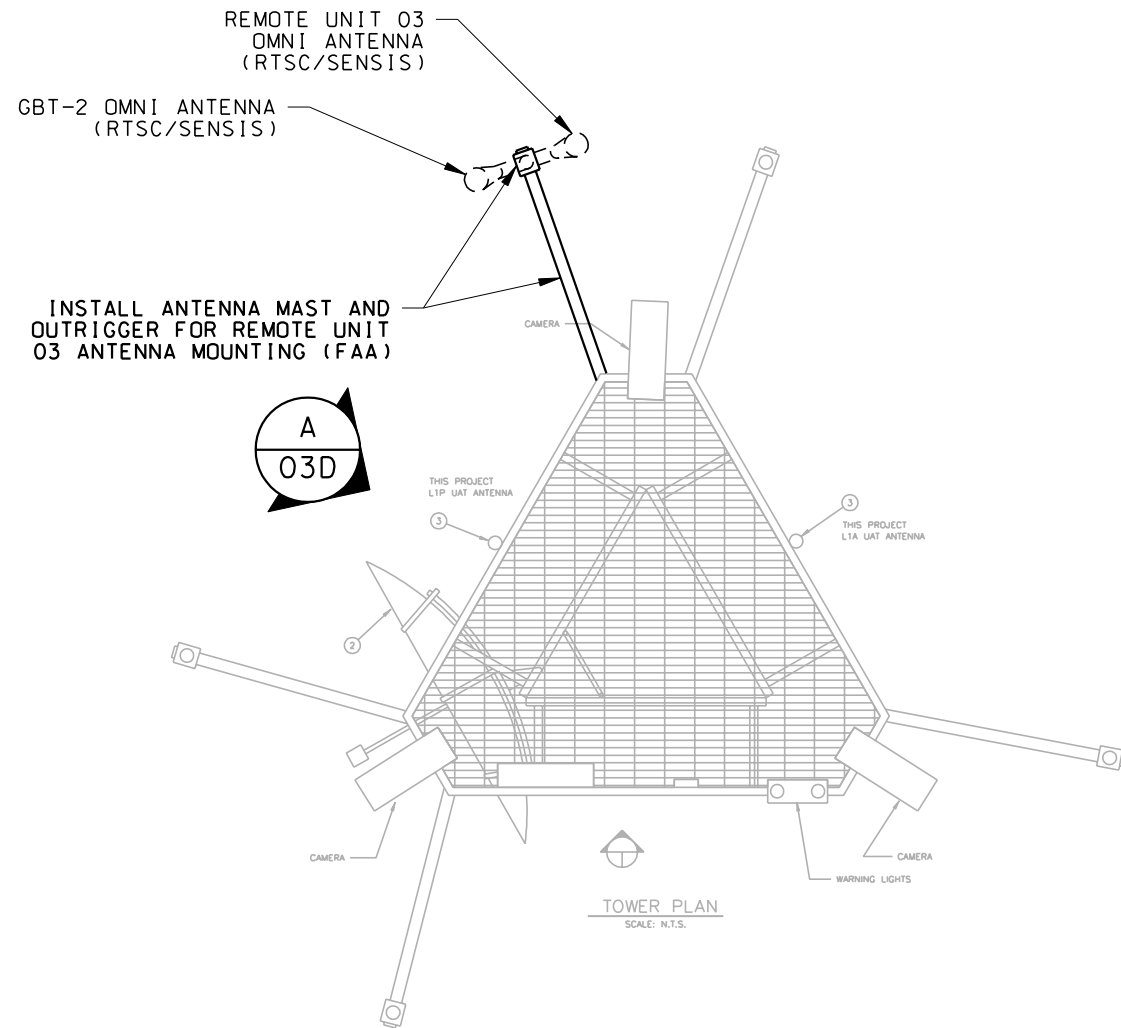
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2

1



REMOTE UNIT 03 & GBT-2 ANTENNA MOUNTING IN EXISTING TOWER - ELEVATION A  
NOT TO SCALE



REMOTE UNIT 03 & GBT-2 ANTENNA MOUNTING IN EXISTING TOWER - PLAN  
NOT TO SCALE

- NOT FOR CONSTRUCTION -

NOTES

1. REFERENCE FAA DRAWING ALD-LPJ-S01, REV 2.

REV.	DATE	DESCRIPTION
N/A	N/A	FINAL SUBMISSION
-	2004/06/25	DRAFT SUBMISSION

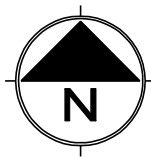
DESIGNED	JM	RAYTHEON TECHNICAL SERVICES COMPANY, LLC		
DRAWN	sis	BURLINGTON MA, 01803		
CHECKED	RNF	WIDE AREA MULTI-LATERATION SURVEILLANCE SYSTEM (WAMSS) - FEDERAL AVIATION ADMINISTRATION, ALASKA REGION, FAIRBANKS, AK		
		REMOTE UNIT 03 & GBT-2 AT LENA POINT, AK		
		REMOTE UNIT 03 ANTENNA MOUNTING		
SCALE: NOTE: THIS DRAWING MAY HAVE BEEN PLOTTED AT A REDUCED OR LARGER SIZE. USE SCALES WITH CAUTION.		CAD FILE	DATE (YYYY/MM/DD)	DRAWING NO
		wamssjnuser03d.dgn	2004/06/25	WAMSS-JNU-SER-03D
				REV. -

4

3

2

1



EXISTING HELIPAD

GROUND ROD AT EACH  
CORNER 10'-0"x3/4" DIA  
COPPER CLAD CONNECTED  
TOGETHER BY CONTINUOUS  
LOOP OF #4/0 CABLEBONDING CLAMP BOLTED  
TO METAL PLATFORM  
AND FOUNDATION REBARS  
OF HELIPAD  
(TYP. OF 4)#4/0 CABLE CONNECTED  
TO METAL PLATFORM  
(TYP. OF 4 PLACES)#4/0 GROUND CABLE  
COUNTERPOISE, BURIED  
24" MIN (TYP.)3'-0" WALKWAY  
(TYP.)POWER  
TRANSFORMER

EXISTING TOWER

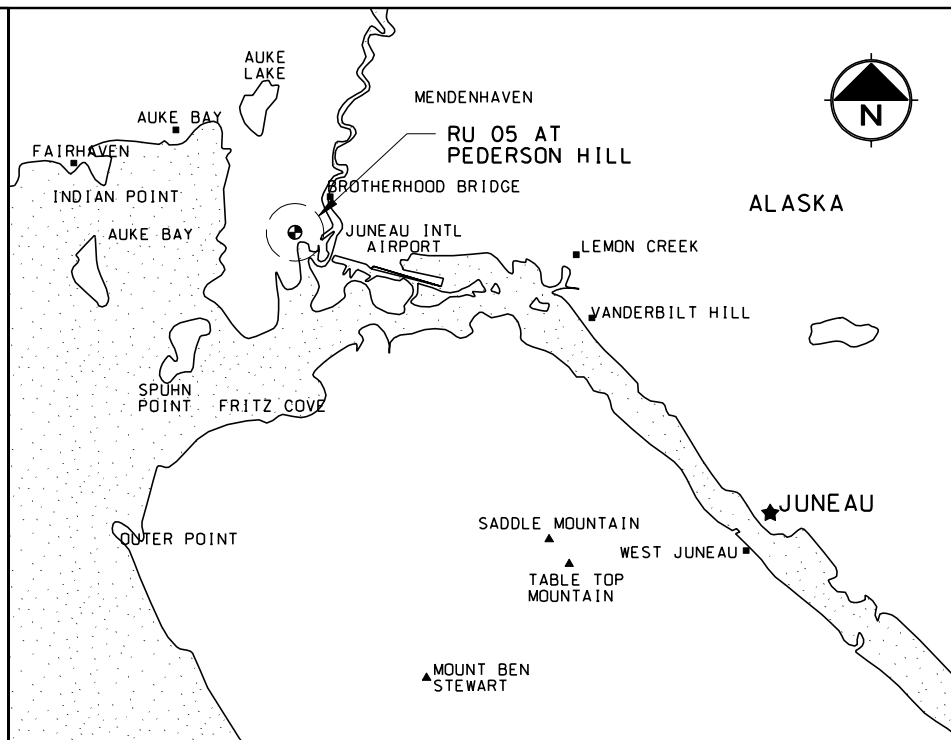
REMOTE UNIT 05 TO BE  
LOCATED IN EXISTING  
EQUIPMENT SHELTER  
(SEE DRAWING WAMSS-  
JNU-SER-05B)EXISTING EQUIPMENT  
SHELTERPRIMARY POWER CABLE  
(15KV CABLE)UTILITY SECONDARY POWER CABLE  
TO COMBINATION SERVICE ENTRANCE  
EQUIPMENTTOWER "A" PLATFORM  
SEE DWGS. ALD-JNU-994.015  
AND ALD-JNU-994.016  
FOR ELECTRICAL PLANSREMOTE UNIT 05 OMNI  
ANTENNA TO BE MOUNTED  
ON EXISTING TOWER  
(SEE DRAWING WAMSS-JNU-  
SER-05B)

## REMOTE UNIT 05 SITE PLAN

SCALE: 1" = 10'

10 0 10 20

SCALE: 1" = 10'



## REMOTE UNIT 05 LOCUS PLAN

NOT TO SCALE

**- NOT FOR CONSTRUCTION -**

## NOTES

1. REFERENCE FAA DRAWINGS ALD-JNU-994.013, REV 1  
& ALD-JNU-154.106, REV 1.

REV.	DATE	DESCRIPTION
N/A	N/A	FINAL SUBMISSION
-	2004/06/25	DRAFT SUBMISSION

DESIGNED	JM	RAYTHEON TECHNICAL SERVICES COMPANY, LLC	
DRAWN	sls		
CHECKED	RNF	BURLINGTON	MA, 01803

WIDE AREA MULTI-LATERATION SURVEILLANCE  
SYSTEM (WAMSS) - FEDERAL AVIATION  
ADMINISTRATION, ALASKA REGION, FAIRBANKS, AK  
REMOTE UNIT 05 AT PEDERSON HILL, JUNEAU, AK  
SITE AND LOCUS PLANSSCALE NOTE: THIS DRAWING MAY HAVE  
BEEN PLOTTED AT A REDUCED OR  
LARGER SIZE. USE SCALES WITH  
CAUTION.

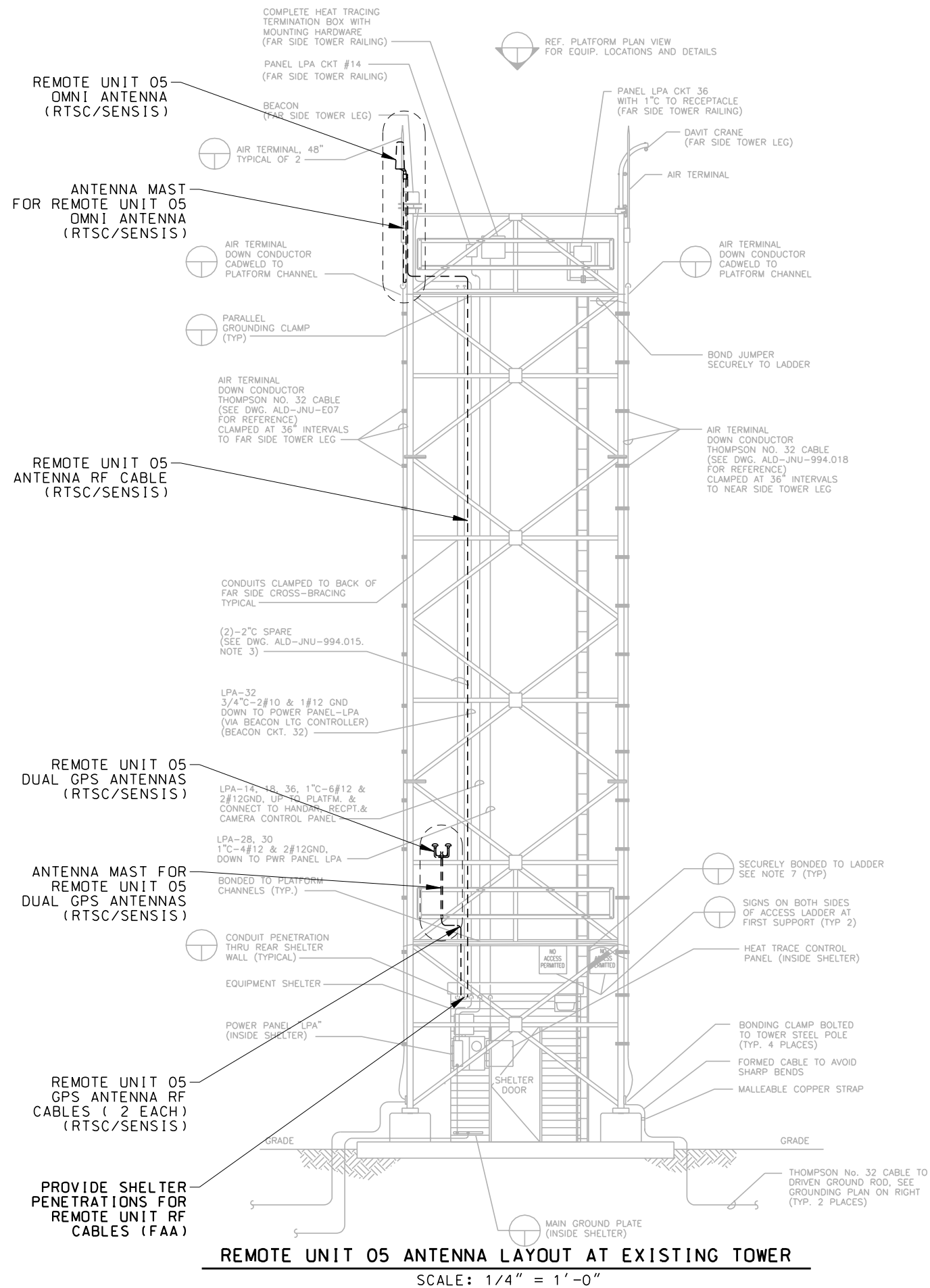
CAD FILE	DATE (YYYY/MM/DD)	DRAWING NO	REV.
wamssjnuuser05a.dgn	2004/06/25	WAMSS-JNU-SER-05A	-

4

3

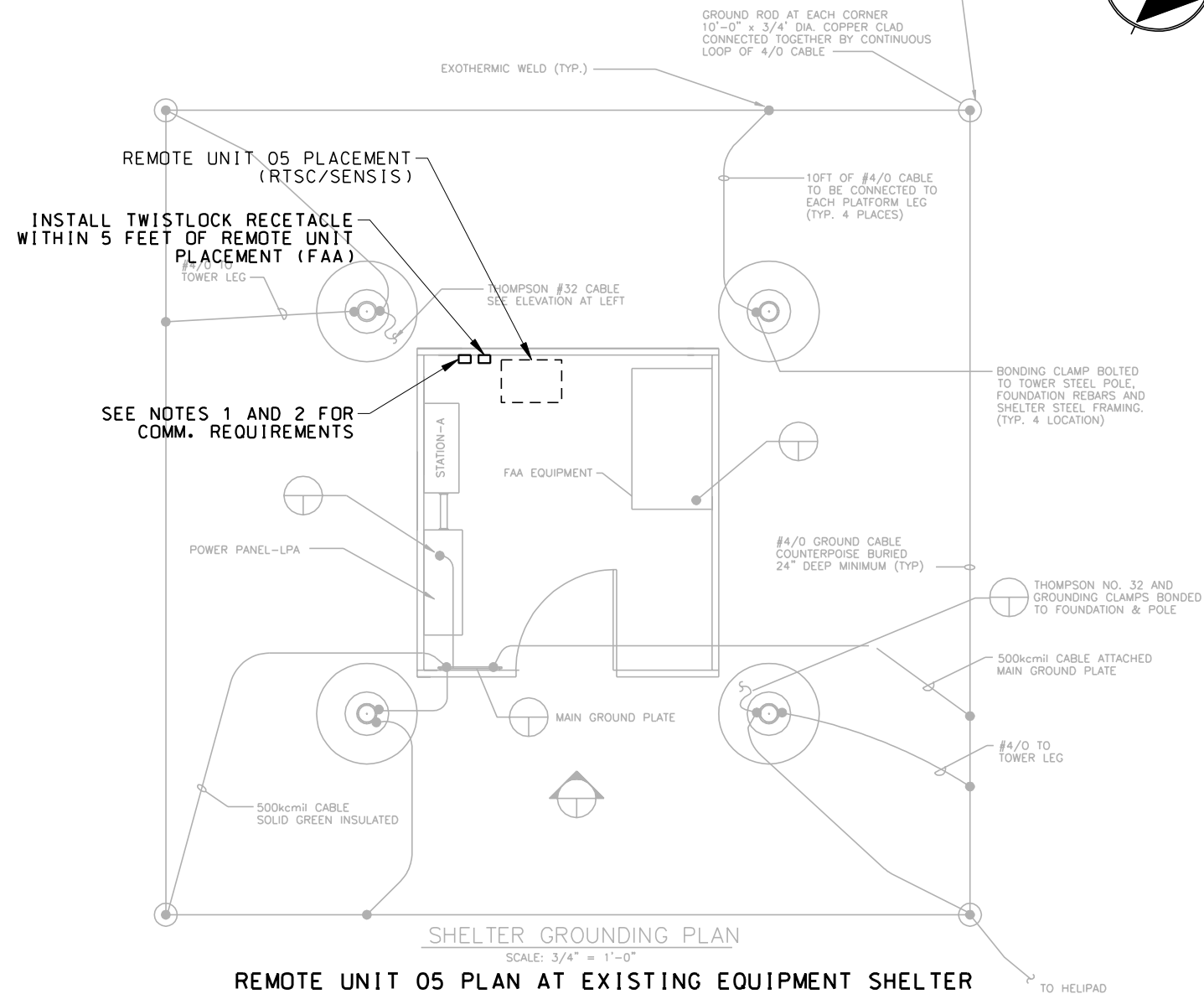
2

1



REMOTE UNIT 05 ANTENNA LAYOUT AT EXISTING TOWER

SCALE: 1/4" = 1'-0"



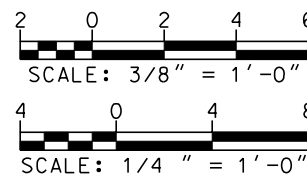
## NOTES

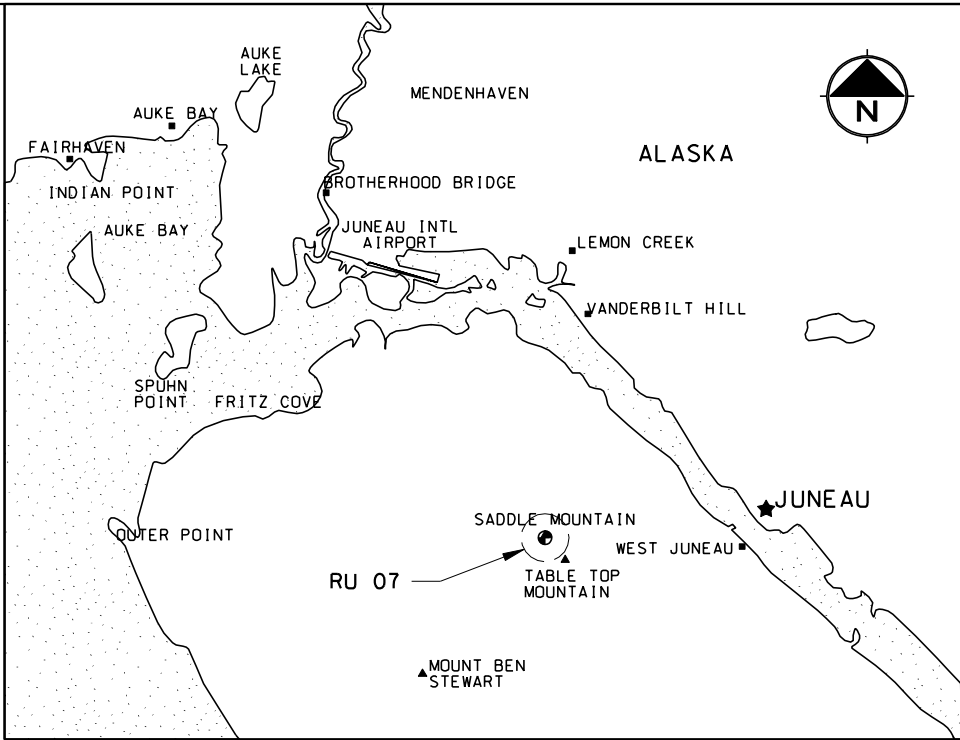
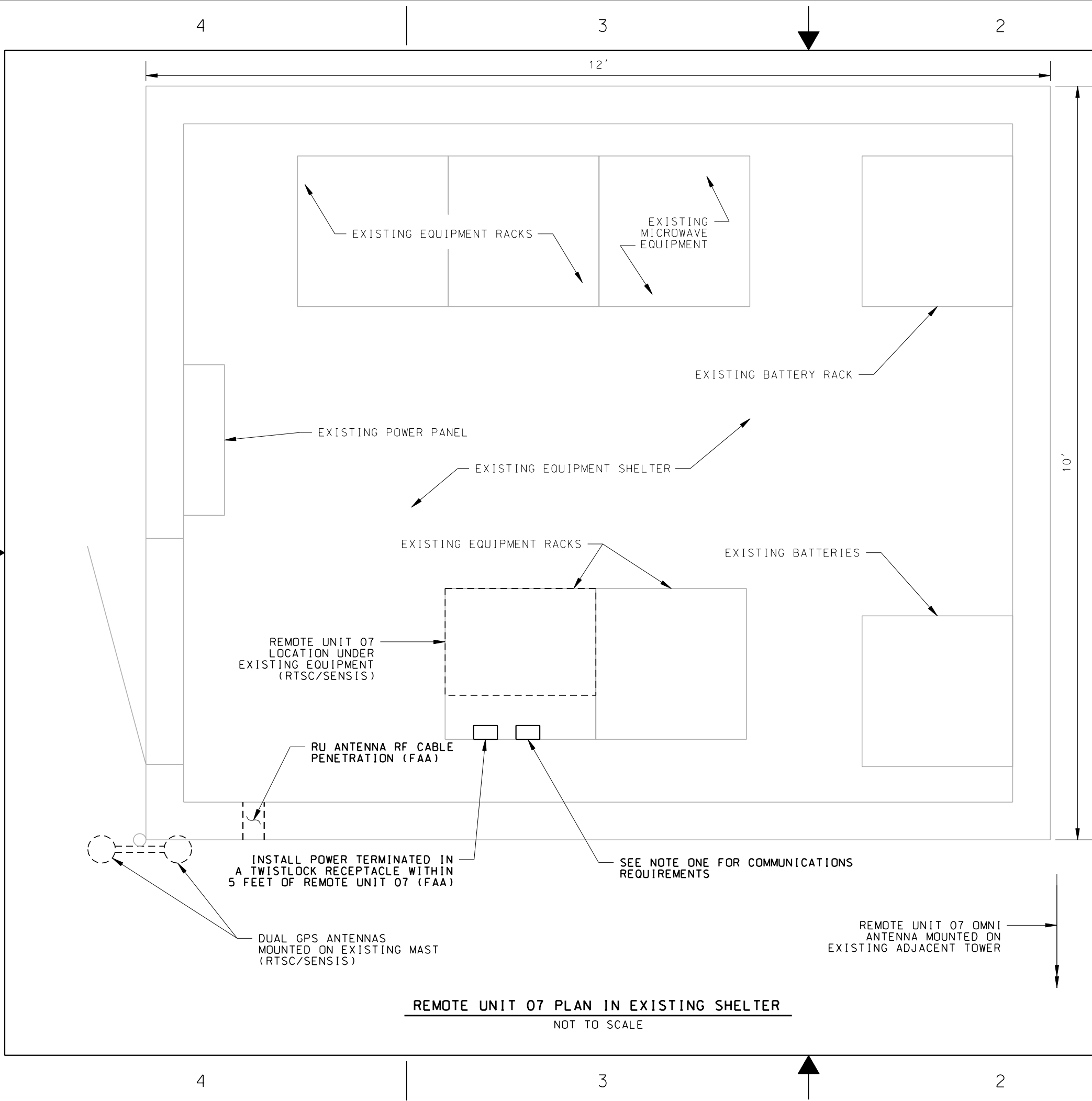
1. INSTALL A SERIAL CONVERSION CARD IN EXISTING DIGITAL MICROWAVE LINK CONNECTED BY A FAA SPECIFIED INTERFACE.
2. FAA TO MAKE ACCOMODATIONS FOR SADDLE MOUNTAIN MICROWAVE LINK
3. REFERENCE FAA DRAWING ALD-JNU-994.016, REV 1.

REV.	DATE	DESCRIPTION
N/A	N/A	FINAL SUBMISSION
-	2004/06/25	DRAFT SUBMISSION

JM	RAYTHEON TECHNICAL SERVICES COMPANY, LLC		
sis			
RNF	BURLINGTON		MA, 01803
	WIDE AREA MULTI-LATERATION SURVEILLANCE SYSTEM (WAMSS) - FEDERAL AVIATION ADMINISTRATION, ALASKA REGION, FAIRBANKS, AK REMOTE UNIT 05 AT PEDERSON HILL, JUNEAU, AK ELEVATION AND PLAN		
	CAD FILE	DATE (YYYY/MM/DD)	DRAWING NO
	wamssjuser05b.dgn	2004/06/25	WAMSS-JNU-SER-05B
			REV. -

SCALE NOTE: THIS DRAWING MAY HAVE BEEN PLOTTED AT A REDUCED OR LARGER SIZE. USE SCALES WITH CAUTION.





**NOTES**

1. INSTALL A SERIAL CONVERSION CARD IN EXISTING DIGITAL MICROWAVE LINK CONNECTED BY A FAA SPECIFIED INTERFACE.
2. REFERENCE FAA DRAWING ALD-JNU-994.016, REV 1.

N/A	N/A	FINAL SUBMISSION
-	2004/06/25	DRAFT SUBMISSION
REV.	DATE	DESCRIPTION

DESIGNED	JM	RAYTHEON TECHNICAL SERVICES COMPANY, LLC		
DRAWN	sls			
CHECKED	RNF	BURLINGTON MA, 01803		
		WIDE AREA MULTI-LATERATION SURVEILLANCE SYSTEM (WAMSS) - FEDERAL AVIATION ADMINISTRATION, ALASKA REGION, FAIRBANKS, AK REMOTE UNIT 07 AT SADDLE MOUNTAIN, AK FLOOR PLAN		
SCALE. NOTE: THIS DRAWING MAY HAVE BEEN PLOTTED AT A REDUCED OR LARGER SIZE. USE SCALES WITH CAUTION.		CAD FILE	DATE (YYYY/MM/DD)	DRAWING NO
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				REV.
				-

**Appendix E:**  
**WAM System Site Preparation Requirement Figures**



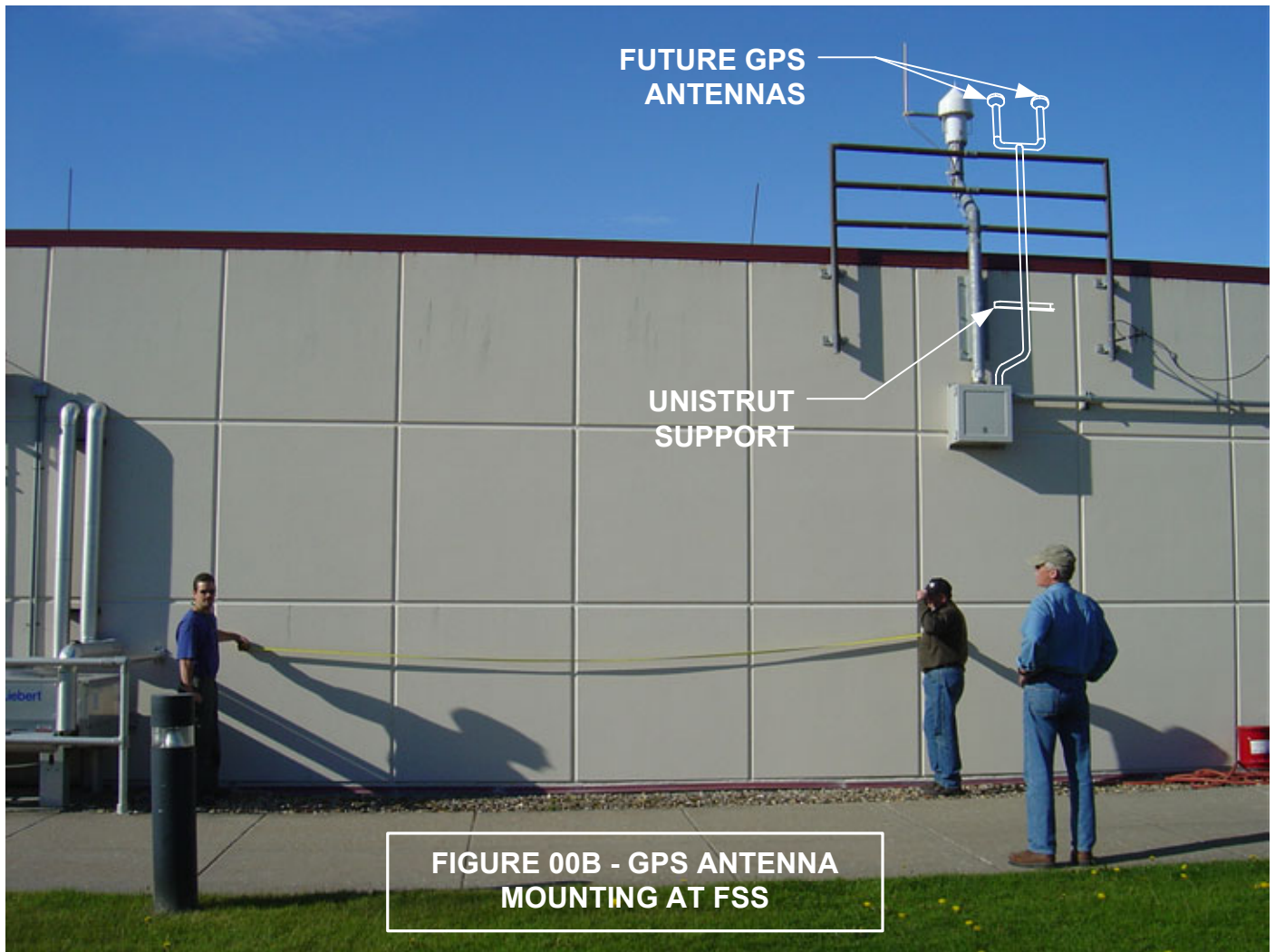
WAMSS RACKS

MDT WORKSTATION

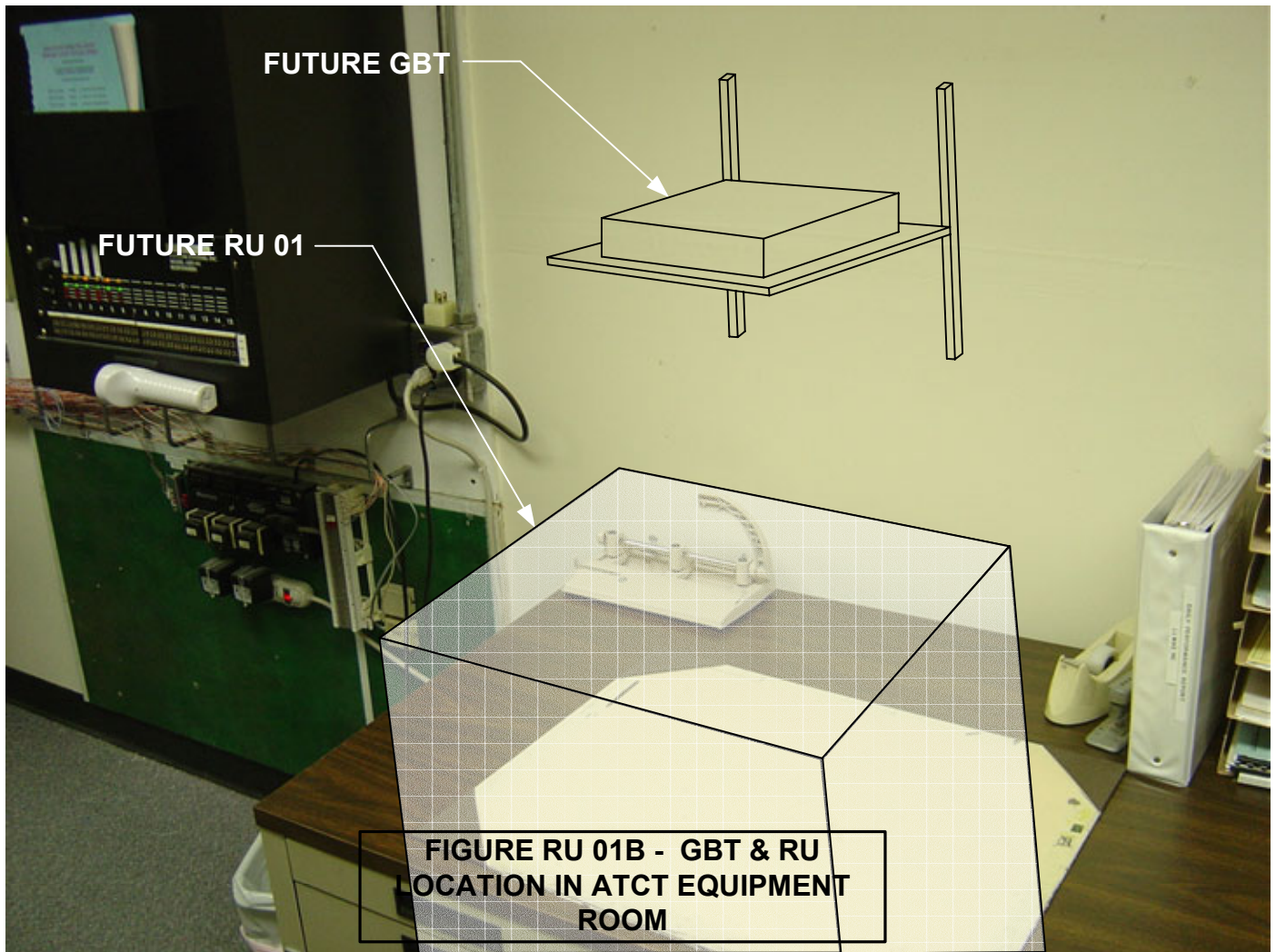
CABLES:  
POWER  
COMMUNICATION  
SIGNAL  
GROUNDING  
(ALL BELOW  
RAISED FLOOR)

EXISTING DESKS TO BE  
RELOCATED

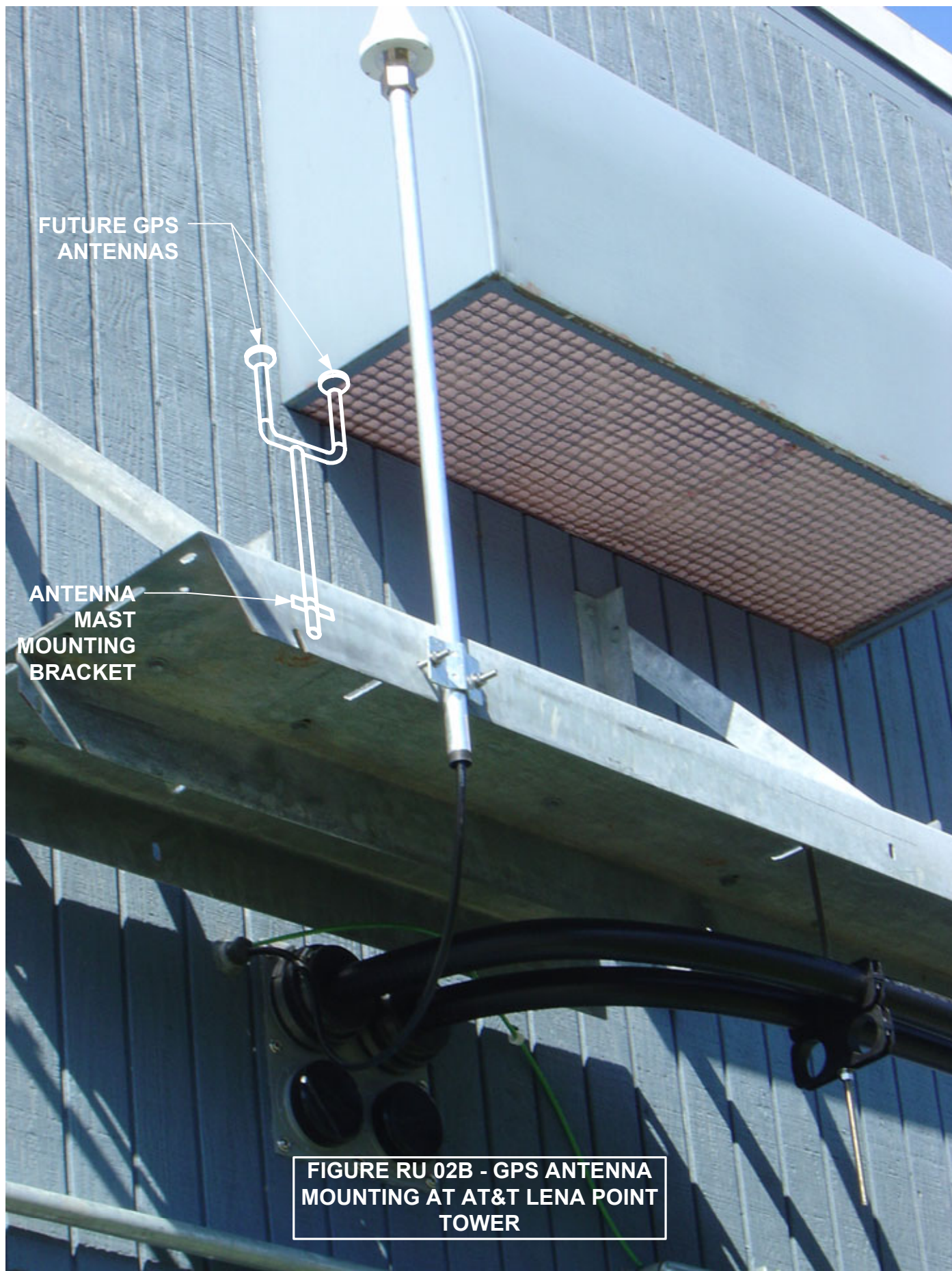
FIGURE 00A  
WAMSS EQUIPMENT IN FSS











FUTURE GPS  
ANTENNAS

ANTENNA  
MAST  
MOUNTING  
BRACKET

FIGURE RU 02B - GPS ANTENNA  
MOUNTING AT AT&T LENA POINT  
TOWER



RF CABLE  
ROUTING

FUTURE GBT

FUTURE RU 03

FIGURE RU 03A - GBT & RU LOCATION  
AT LENA POINT FAA RCAG FACILITY







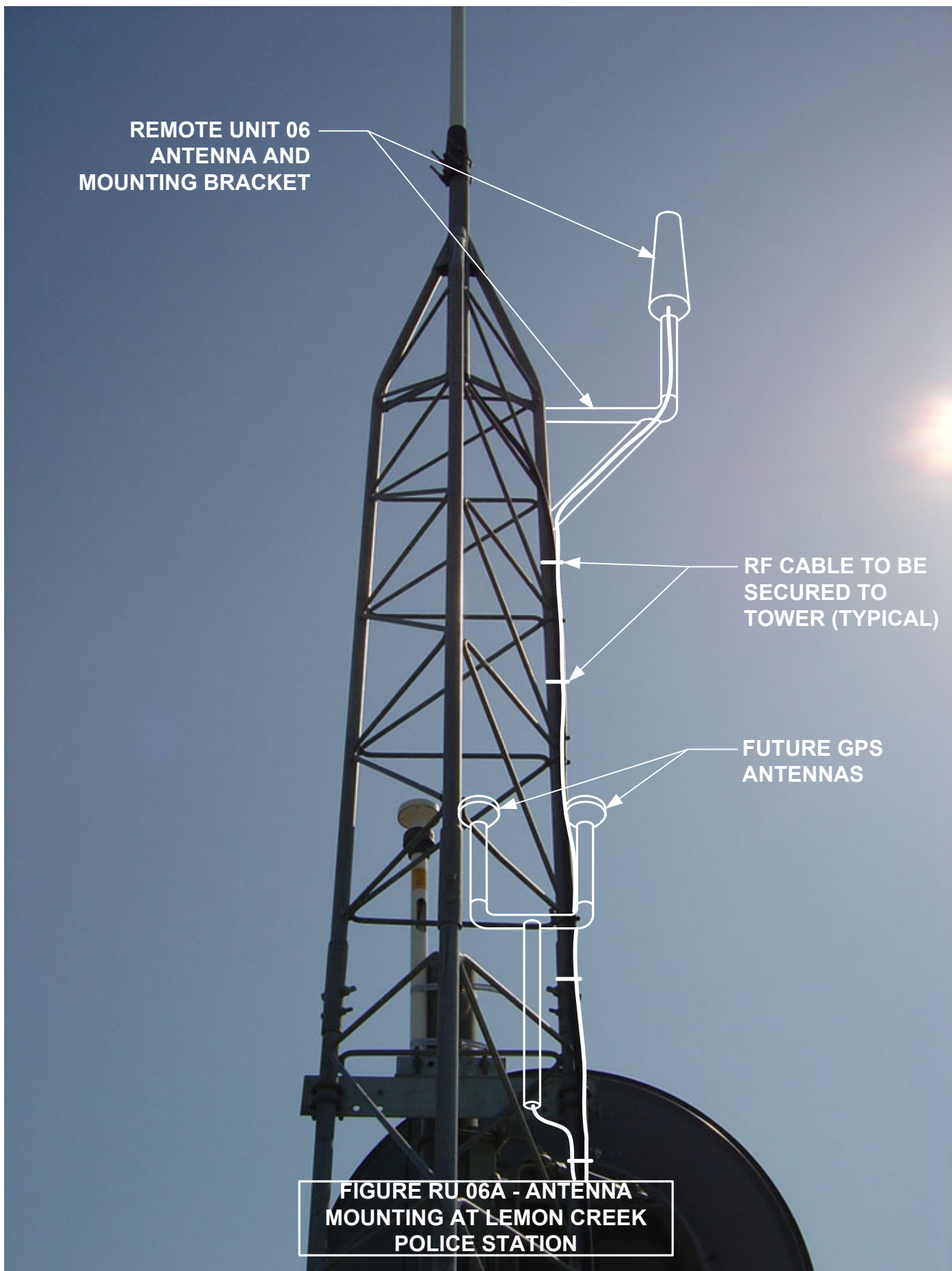


REMOTE UNIT 06  
ANTENNA AND  
MOUNTING BRACKET

RF CABLE TO BE  
SECURED TO  
TOWER (TYPICAL)

FUTURE GPS  
ANTENNAS

FIGURE RU 06A - ANTENNA  
MOUNTING AT LEMON CREEK  
POLICE STATION



RU 07A ANTENNA TO BE MOUNTED ON THIS TOWER

EXISTING EQUIPMENT TO BE RELOCATED UPWARD, ABOVE THE PROPOSED REMOTE UNIT



SADDLE MOUNTAIN POLICE RADIO SITE OVERVIEW

FUTURE REMOTE UNIT

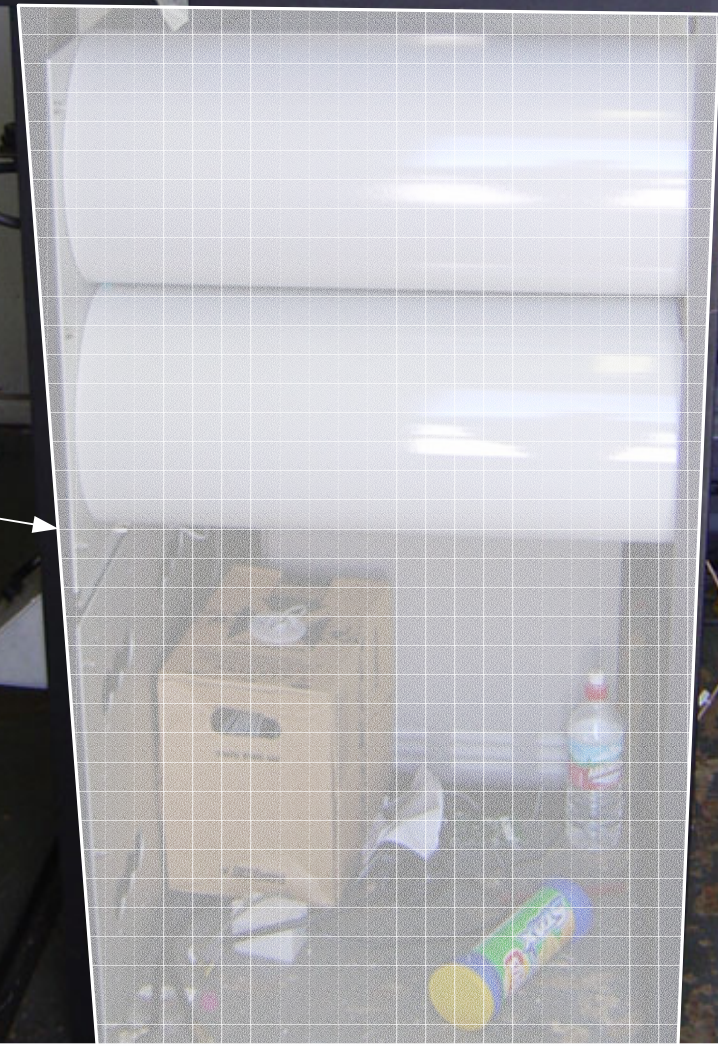


FIGURE RU 07A  
REMOTE UNIT LOCATION AT SADDLE MOUNTAIN  
POLICE RADIO SITE

FUTURE GPS  
ANTENNAS

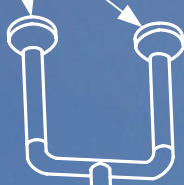
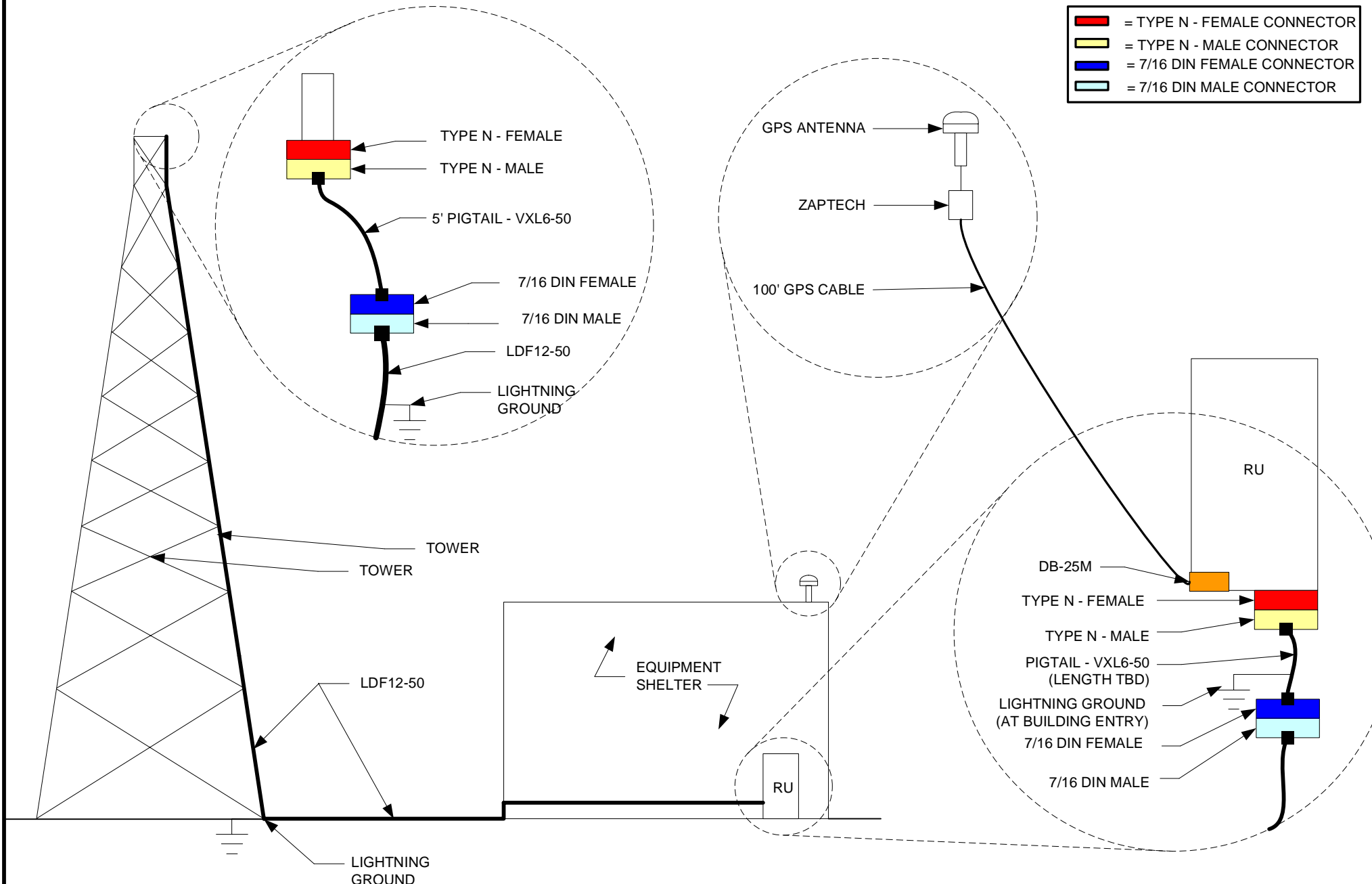


FIGURE RU 07B - GPS ANTENNA  
MOUNTING AT SADDLE  
MOUNTAIN POLICE RADIO SITE

**Appendix F:**  
**AT&T Tower Typical RF Transmission Line**

# LEGEND

- = TYPE N - FEMALE CONNECTOR
- = TYPE N - MALE CONNECTOR
- = 7/16 DIN FEMALE CONNECTOR
- = 7/16 DIN MALE CONNECTOR



**AT&T TOWER  
TYPICAL RF TRANSMISSION LINE**

## **Appendix G: GBT Assembly Views**

